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Essays in the Political Economy of Information

A dissertation presented

by

Julia Cagé

to

The Department of Economics

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

in the subject of

Economics

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Essays in the Political Economy of Information

Abstract

The primary focus of this dissertation is on information, its production and dissemination in society. In the first chapter, I explore the consequences of an increase in the number of newspapers on the quantity and quality of news provided and, ultimately, changes in political participation, using a new panel of local newspaper presence and political turnout in France from 1945 to 2012. My results shed new light on the role played by consumers' heterogeneity and increasing returns to scale in news production, and have implications for the study of the relationship between media competition and political participation.

The second chapter delves into the relationship between newspapers and civic attitudes. I build a new geocoded dataset locating Protestant missions in 1903 to examine the long-term consequences of the introduction of the printing press. I show that, within regions located close to missions, proximity to a printing press significantly increases newspaper readership today. I also document a strong association between proximity to a printing press and contemporary economic development, and show that newspaper readership may explain this positive relationship.

The dissemination of information – through the media – has important and various implications. In the third chapter, I study the effect of firm and country reputation on exports when buyers cannot observe quality prior to purchase. Measuring national reputations by analyzing the content of US newspaper articles about foreign countries over 1988-2006, I find that more positive news coverage of foreign countries and companies is associated with higher unit values of their exports to the US.

Given the importance of the media, key is to improving our understanding of its

business model. In the fourth chapter, I focus on one particular aspect, namely newspapers' pricing policies. I investigate how the reliance on advertising revenues affects the incentives newspapers have to charge a lower price per issue to subscribers than to occasional buyers. To this end, I rely on history and exploit the introduction of advertisement on French Television in 1968.

Finally in the last chapter, I study the emergence of market-oriented journalism and of an independent and informative press in sub-Saharan Africa.

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Introduction

This dissertation lies at the intersection of Political Economy and Economic History. Its primary focus is on information, its production and dissemination in society. I use a broad set of tools to address this topic. On the theory side, I apply formal models in Political Economy as well as in Industrial Organization. In my empirical work, I construct large-scale historical datasets; I rely on historical “quasi-natural" experiments to build sharp empirical strategies. In particular, I collect and compile new variables based on detailed historic data to study the evolution of the media, both in France and in sub-Saharan Africa, and how it affects different political and economic outcomes.

Will an increase in competition in the market place for news and ideas triggered by technical change and information technologies lead to a better coverage of general information and an increase in political participation? There seems to be a consensus that it will be the case. More media competition is indeed usually seen as welfare improving. The goal of the first chapter of this dissertation (*“Media Competition, Information Provision and Political Participation”*) is to revisit this common wisdom, relying on the history of the French media market. The welfare impact of media competition depends on the incentives of the media to deliver news. In this chapter, I explore the consequences of an increase in the number of newspapers on the quantity and quality of news provided and, ultimately, changes in political participation. Drawing from the literature on vertical product differentiation to model the production choices of newspapers, I show how an increase in the number of newspapers can decrease both the quantity and quality of news provided. I build a new county-level panel dataset of local newspaper presence, newspapers’ costs and revenues and political turnout in France, from 1945 to 2012. I estimate the effect of newspaper entry by comparing counties that experience entry to similar counties in the same years that do not. These counties exhibit similar trends prior to newspaper entry, but newspaper entry then leads to substantial declines in the total number of journalists. More newspapers are also associated with fewer news articles and lower hard news provision. These effects are concentrated in counties with homogeneous populations, as predicted by my simple theoretical framework, with little impact on counties with heterogeneous populations. Newspaper entry, and the associated decline in information provision, is ultimately found to decrease voter turnout. These results shed new light on the role played by consumers' heterogeneity and increasing returns to scale in news production, and have implications for the study of the relationship between media competition and political participation.

The second chapter of the dissertation (*"The Long-Term Effects of the Printing Press in sub-Saharan Africa"*) delves into the relationship between newspapers and civic attitudes; I focus on sub-Saharan Africa and explore the effects of newspaper readership on political participation and economic change using the historical development of the media. In sub-Saharan Africa, Protestant missionaries were the first both to import the printing press technology and to allow the indigenous population to use it. I build a new geocoded dataset locating Protestant missions in 1903. This dataset includes, for each mission station, the geographic location and its characteristics, as well as the educational and health-related investments undertaken by the mission. I show that, within regions located close to missions, proximity to a printing press significantly increases newspaper readership today. I also document a strong association between proximity to a printing press and contemporary economic development, and show that newspaper readership may explain this positive relationship.

The dissemination of information – through the media – has important and various implications. In the third chapter of the dissertation (*"Improving "National Brands": Reputation for Quality and Export Promotion Policies"*), I study the effect of firm and country reputation on exports when buyers cannot observe quality prior to purchase. Firm-level demand is determined by expected quality, which depends on both past experience with the good and the country of origin's reputation for quality. Asymmetric information acts as a barrier to entry for high-quality firms but facilitates sales by "fly-by-night" low-quality firms. I derive two types of steady-state equilibria with endogenous reputation. In a high-quality equilibrium, imperfect information does not hinder entry into export markets, but there is a distortion in profits and in the quality composition of exports. In a low-quality equilibrium, I obtain a sorting of firms into exporting that is non-linear in quality. A range of relatively high-quality firms are permanently kept out of the market by the informational friction, so that countries with bad quality reputation can be locked into exporting low-quality, low-cost goods. Export subsidies then have a positive welfare effect on the exporting country, by improving the average quality of its exports and its terms of trade. However, a subsidy has the opposite long-run effects in a country that initially exports relatively high-quality products. Moreover, measuring national reputations by analyzing the content of US newspaper articles about foreign countries over 1988-2006, I find that more positive news coverage of foreign countries and companies is associated with higher unit values of their exports to the US, particularly in sectors with a larger scope for vertical differentiation.

Given the importance of the media, it is thus key to improving our understanding of its business model. In the fourth chapter of this dissertation, (*"Price Discrimination in a Two-Sided Market: Theory and Evidence from the Newspaper Industry"*), I focus on a particular aspect, namely newspapers' pricing policies. I investigate how the reliance on advertising revenues affects the incentives newspapers have to charge a lower price per issue to subscribers than to occasional buyers (second-degree price discrimination). I build a model in which a newspaper must attract both readers and advertisers. Readers are uncertain as to their future benefit from reading, and heterogeneous in their taste for reading. Advertisers are heterogeneous in their outside option, taste for subscribers, and taste for occasional buyers. To estimate empirically the effect of the advertisers' side of the industry on price discrimination on the readers' side, I rely on history and exploit the introduction of advertisement on French Television in 1968 – a "quasi-natural" experiment. I treat this introduction as a negative shock on advertising revenues of daily national newspapers (treated group), but not on daily local newspapers (control group). I build a new dataset on French local newspapers between 1960 and 1974 and perform a Differences-in-Differences analysis. I find robust evidence of increased price discrimination as a result of a drop in advertisement revenues.

Finally, the last chapter of this dissertation (*"The Economics of the African Media"*) lays the foundation for future research in which I plan to explore how media content affects economic development, in particular in sub-Saharan Africa. Using the history of sub-Saharan African newspapers as well as historical evidence from Europe and the United States, I study the emergence of market-oriented journalism and of an independent and informative press in sub-Saharan Africa. I document the extent to which sub-Saharan African newspapers have followed the same development steps than newspapers in other countries, moving from living off patronage and government favors to moving more towards mass sales and advertising revenues. I show that the story of the sub-Saharan African media is not a simple story of catching up and convergence. In particular, through the study of the economics of the sub-Saharan African media, I challenge traditional views of the media. I question the long-term sustainability of advertising-dependent media and discuss a new framework to improve the financial sustainability of mass media while preserving the independence of media outlets. I document the pros and cons of ownership concentration and argue in favor of the development of synergies between national and local newspapers as well as of the development of nonprofit media organizations.

Chapter 1

Media Competition, Information Provision and Political Participation

1.1 Introduction

Will an increase in competition in the marketplace for news and ideas – triggered by technical change and information technologies – lead to a better coverage of general information and an increase in political participation? This paper investigates the consequences of an increase in the number of media outlets on the quantity and quality of news provided and, ultimately, changes in voter turnout at elections.

More media competition is often seen as implying an increase in the dissemination of information, thereby enhancing the extent of ideological diversity, promoting truth and contributing to the political process.[1] In this spirit, recent studies in political economy have advanced the existence of a positive causal link between media entry and political participation (Stromberg, 2004; Oberholzer-Gee and Waldfogel, 2009; Gentzkow *et al.*, 2011). However the focus of these studies is on media access – the move from 0 to 1 media outlet. In this paper, I consider instead media competition – the move from $n > 0$ to $n + 1$ media

[1] According to Hamilton (2004), *""more news is better news" appears to be an axiom favored in discussions about the news marketplace."* (p.21).

outlets. There is indeed no reason to expect that the intensive margin of the media acts as the extensive margin; in particular because media competition may affect the content of media outlets.

To tackle these questions, I first provide a motivating theory model. I draw from the literature on vertical product differentiation to study the production choices (price and quality) of newspapers under monopoly and duopoly. There are a continuum of heterogeneous consumers and two profit-maximizing newspapers facing quality-dependent fixed costs. Newspapers first choose simultaneously their quality and then compete simultaneously in price. Consumers are heterogeneous with respect to their willingness-to-pay for newspaper quality. When heterogeneity in consumers' willingness-to-pay is high, the market is not covered under competition. The entrant expands the market and newspapers differentiate on quality to soften price competition and increase market power. One duopolist produces a lower-quality newspaper than the monopolist, and the other one a higher-quality newspaper. On the contrary, when heterogeneity is low, the market is covered under competition. In the extreme case with no heterogeneity, the entrant garners half of the market and halves the incumbent newspaper's circulation (business stealing). Consumers derive no additional benefit from the new newspaper, but resource use on fixed costs is doubled, reducing social surplus. Both duopolists produce a lower-quality newspaper than the monopolist.

In an extension of the model, I divide newspaper content between "hard news" and "soft news".[2] Hard news corresponds to public affairs news, for example national and international news or economic news, and tends to be regarded as informative in the political process. On the contrary, soft news corresponds to entertaining or commodity news, say about sports or fashion. Consumers are heterogeneous with respect to their willingness-to-pay for these two attributes of newspapers. If there is more heterogeneity in the willingness-to-pay for an attribute (say soft news) than for the other (say hard news), everything else being symmetrical, I find that both duopolists reduce the quality of the

[2] I use here the terminology hard in the colloquial and political science meaning of hardness as a measure of information content. Hard is not hard in the economic sense of verifiability.

low-heterogeneity attribute (in this case hard news) compared to the monopolist.[3] The intuition is as follows: both newspapers benefit from differentiating on the dimension with higher heterogeneity so as to relax price competition, but they offer the lowest quality of the dimension with lower heterogeneity to contain costs.

Ultimately, if more informed voters are more likely to vote (see e.g. Feddersen and Pesendorfer, 1996, 1999; Lassen, 2005; Feddersen and Sandroni, 2006a,b), then an increase in competition leads to a decrease in political participation at elections when heterogeneity in the willingness-to-pay for quality is low.

This simple theoretical framework guides the empirical exercise and aids in interpreting the results. The empirical analysis has three objectives. First, I test for and quantify the effect of entry on the quality of newspapers, and explore how this effect varies with the extent of heterogeneity. Second, I extend the analysis to investigate how the entry of a newspaper affects the share of hard news in newspapers and how this effect varies with the relative heterogeneity in the willingness-to-pay for hard and soft news. Finally, I measure the impact of a change in the number of newspapers on turnout at elections and study the extent to which this impact depends on heterogeneity.

To perform this analysis, I build a new panel of local daily newspapers and turnout at local elections in France from 1945 to 2012. For several reasons, the French local daily newspapers industry is well suited to testing the predictions of my simple theoretical framework. First, with on average more than 70% of the egilible voters in a county reading a local daily newspaper everyday, this industry may be key to political participation at the county level.[4] Second, during this time period, I observe many entries and exits of newspapers that I can use for identification. Finally, I choose to focus on this industry because of the availability of excellent data. My dataset includes every local daily newspaper

[3] Higher heterogeneity in the tastes for soft news may come from the fact that soft news has more dimensions (music, sport, movies, crime,...) than the political space which can often be reduced to two dimensions.

[4] In this paper, for the sake of simplicity, I use the term "county" when refering to a "département". In the administrative division of France, a "département" corresponds roughly to a county in the United States (more on this below).

published in France over this time period. I determine for each year between 1945 and 2012 the number of newspapers present in each French county – the natural news market; I collect annual data on each paper's location and circulation. For the sub-period 1960-2012, I collect annual information on each paper's costs and revenues, as well as on the number of employees.[5] I use this data to quantify the effect of entry on the quality of newspapers; following the existing literature, I use the number of journalists on staff as my first proxy for newspaper quality (see e.g. Hamilton, 2004; Berry and Waldfogel, 2010). I supplement this data for recent years (2005-2012) with measures of newspaper content, in particular of the size of newspapers (number of articles and of words). This data allows me to study how the quantity of news provided by newspapers varies with the market structure. I use the quantity of news as my second proxy for newspaper quality; more content is indeed presumably always preferred to less (see e.g. Berry and Waldfogel, 2010). Finally, I use newspaper content data to classify each article as hard news or soft news. This information allows me to test the prediction of the extension of my simple theoretical framework on the impact of newspaper competition on the share of hard news.

The first empirical challenge is to isolate the impact of newspaper entry on incumbent newspapers. My identification strategy uses the timing of entries as shocks affecting incumbents. I estimate the effect of newspaper entry by comparing counties that experience an entry to similar counties in the same years that do not. Because the entry decision is made to maximize profits, counties that experience an entry are likely to differ from other counties, both at the time of entry and in future periods. The identifying assumption is that newspapers in these other counties form a valid counterfactual for the incumbent newspapers in counties that experience an entry, after conditioning for differences in pre-existing trends, newspaper fixed effects, year fixed effets, and a large set of demographic covariates controlling for the age composition, occupational structure and educational level

[5]To give a flavour of what is generally available in terms of newspaper cost and revenue data, it is worth remembering that in their study of how economic incentives shape ideological diversity in the media, Gentzkow *et al.* (2012) have no other choice but to use balance sheet data on anonymous newspapers that they match with newspapers using circulation value. On the contrary, I have actual annual balance sheet data for French local daily newspapers from 1960 to 2009.

of counties. In particular, I show that counties that experience entry and these counterfactual counties exhibit similar trends in circulation, revenues, expenses and number of employees prior to newspaper entry. I use both an aggregate event studies and a fixed-effect model allowing for time-varying effects of entry to perform this analysis.

The second empirical challenge is to quantify the extent of heterogeneity in the willingness-to-pay across counties. While the theoretical framework yields a precise measure of heterogeneity, the choice of data is more problematic. First, I compute a measure of heterogeneity in the willingness-to-pay for quality based on the distribution of individuals across socio-economic groups. The higher the probability that two randomly selected individuals in a county belong to two different socio-economic groups, the higher the heterogeneity in this county. Second, to test the prediction of the extended version of the simple theoretical framework, I quantify the relative heterogeneity in the willingness-to-pay for hard news and soft news. I proxy the willingness-to-pay for hard news with a measure of political polarization: the share of the votes for extreme-right and extreme-left parties.

The empirical evidence confirms the predictions of my theoretical framework. First, I show that entry reduces the circulation of incumbent newspapers by nearly 25%. This business stealing is particularly strong in low-heterogeneity areas (44%), as predicted by the model. This leads to a 20 to 36% decrease in incumbent newspapers' revenues and expenses and a 57% decrease in the number of journalists working for incumbent newspapers in low-heterogeneity counties. This decrease in the number of journalists is not compensated by an overall increase in the aggregate number of journalists working at the news-market level. Second, using data for recent years (2005-2012), I show that an additional newspaper leads to a 14 to 29% decrease in newspapers' size, to a 9 to 13% decrease in the share of hard news and to a 25 to 32% decrease in the amount of hard news. The decrease in hard news is driven by counties in which political polarization is low. Moreover I find that more competition leads to more newspaper differentiation and that this effect is lower in low-heterogeneity counties in which newspapers have less space for differentiation.

Finally, I look into the impact of media competition on participation at elections. I match my data on the number of local newspapers with city-level data on turnout at mayoral elections that I digitize from official records.[6] My empirical strategy follows Gentzkow *et al.* (2011). I look at changes in political participation in cities that experience a newspaper entry or exit relative to other cities in the same region and year that do not. I find that an increase in newspaper competition has a robust negative impact on turnout at local elections, with one additional newspaper decreasing turnout by approximately 0.3 percentage points. When considering only low-heterogeneity areas, this negative impact increases to 0.6 percentage points. This effect is robust to a range of alternative specifications and controls which bring confidence in interpreting it as being causal.

The remainder of the paper is organized as follows. Section 1.2 below relates my work to the existing literature. Section 1.3 lays out the simple theoretical framework. In Section 1.4, I describe the French local daily newspapers industry and review the new dataset I build for this study. Sections 1.5 and 1.6 test the predictions of the model. In Section 1.5, I study empirically the impact of an entry on the quality of newspapers (measured by the number of journalists and the size of newspapers) and on the content they produce (the share of hard news). In Section 1.6, I investigate the impact of changes in the number of newspapers on turnout at local elections. Section 2.5 discusses alternative mechanisms and external validity. Finally, Section 1.8 concludes.

1.2 Relation to Existing Literature

My results complement a growing literature on media and politics. Considering different media outlets, a number of papers have found that media access increases political participation (Stromberg, 2004; Gentzkow, 2006; Oberholzer-Gee and Waldfogel, 2009; Schulhofer-Wohl and Garrido, 2009; Banerjee *et al.*, 2010; Snyder and Strömberg, 2010; Gentzkow *et al.*,

[6] City-level data on turnout at mayoral elections is hardly available in the United States. Ferreira and Gyourko (2009) collect information on mayoral elections between 1950 and 2005 in over 400 cities which is, to the extent of my knowledge, the most complete dataset as of today.

2011; Campante *et al.*, 2013).[7] My paper contributes to this literature by studying the non-monotonicity of this finding. Moving from 0 to 1 newspaper (media access) can have very different effects than moving from $n > 0$ to $n + 1$ newspapers (media competition). Under certain conditions, an increase in the competitiveness of the market may indeed lead to a "race to the bottom" with a dumbing-down of newspapers' content and a decrease in political participation (Zaller, 1999; Arnold, 2002). Considering the intensive margin of the media is thus of particular importance in today's high-choice media environment.

To the extent of my knowledge, Drago *et al.* (2013) is the only paper studying the effect of newspaper competition on electoral participation beyond the effect of newspaper access.[8] They find that the entry of local newspapers leads to an increase in turnout in municipal elections in Italy. They also find that it increases total readership per capita. In the theoretical framework I develop in this paper, such a market expansion could explain the increase in turnout they obtain and might be due to high heterogeneity of Italian readership. Determining whether it is the case requires modeling – and testing – the incentives of the media to deliver news. This is the second contribution of my paper.

While the existing literature has focused on the economic incentives that shape ideological diversity in the media (Strömberg, 2004; Mullainathan and Shleifer, 2005; Gentzkow and Shapiro, 2006; Anand *et al.*, 2007; Gentzkow *et al.*, 2012; Qin *et al.*, 2013), I model and test empirically how an increase in the number of newspapers in a news market affects the quality of newspapers (the size of the newsroom and the number of articles) and the share of hard news in newspapers' content. In my setting, newspapers face heterogeneous consumers which differ *vertically* in their willingness-to-pay for quality rather than *horizontally* in their political bias. From this point of view, my paper is related to the research on product quality in the context of vertical consumer heterogeneity (Shaked and Sutton,

[7] Gentzkow *et al.* (2011), using a panel of local US daily newspapers, show that one additional newspaper increases turnout at national elections but underline that the effect is "driven mainly by the first newspaper in a market".

[8] Becker and Milbourn (2011) study the effect of increased competition in the ratings industry on the quality of ratings and find that it tends to decrease this quality.

1982; Tirole, 1988; Choi and Shin, 1992; Motta, 1993). Following Wauthy (1996), I offer the complete characterization of quality choices without assuming ex ante that the market is, or not, covered. But while in Wauthy (1996) there is no cost of producing quality, I model competition under fixed costs of quality improvement. Newspapers indeed operate under increasing returns to scale. Moreover, dividing the content of newspapers between hard and soft news, I introduce a second dimension of vertical differentiation (Vandenbosch and Weinberg, 1995; Lauga and Ofek, 2011).

Investigating newspapers' decision to supply different type of news is important because different consumers may sort into different news.[9] Increased competition in the media market – or reciprocally, ownership consolidation through mergers (Fan, 2013) – may affect this decision. Using evidence from radio broadcasting, Berry and Waldfogel (2001) find that increased concentration increases variety.[10] Similarly, focusing on the impact of market size on product quality, Berry and Waldfogel (2010) show that in daily newspapers, the average quality of products increases with market size, but that the market does not offer much additional variety as it grows large. They measure quality with the paper's number of pages and of reporters on staff. George (2007) also uses data on reporters when studying how differentiation and variety increase with concentration in markets for daily newspapers.[11] My research differs from this past empirical work in the direct use of media content to measure the size of newspapers and the shares of hard and soft news[12], in the large sample of media outlets I cover (264 newspapers), and in my ability to study these effects over a

[9] Gentzkow (2006) and Prior (2005) find for example that once television and cable TV, respectively, become available to US viewers, some of them stop watching news programs and sort into entertainment programs.

[10] See also Della Vigna and Kennedy (2011) on media concentration and bias coverage.

[11] In their study of the effect of the *New York Times* penetration on local product positioning, George and Waldfogel (2006) similarly use data on the assignment of reporters and editors to topical beats.

[12] There is a growing empirical literature studying newspaper content but its focus is on political bias and not on the quantity or kind of news produced. Various measures of media bias have been used, in particular measures of newspapers' political leanings (endorsement, candidate mentions,...) using automated searches of news text. Groseclose and Milyo (2005) proxy the political positions of US media outlets by the average ideology of the think tanks they quote. Gentzkow and Shapiro (2010), exploiting the Congressional Record, use similarities between language used by media outlets and congressmen. Finally, Puglisi and Snyder (2011) propose a new method for measuring the relative ideological positions of newspapers using data on ballot propositions.

long period of time (1945-2012).

1.3 Theoretical Framework: Competition and News Production

In this section, I present a simple theoretical framework that guides the subsequent empirical exercise and aids in interpreting the results.

There is a continuum of consumers of mass 1 and two profit-maximizing newspapers under duopoly, newspaper 1 and newspaper 2 (only one newspaper under monopoly, newspaper m). I study the production choices (price and quality) of newspapers under monopoly and duopoly. The analysis is based on a two-stage non-cooperative sequential game. Newspapers first choose simultaneously their quality and then compete simultaneously in price.

1.3.1 Model Set-Up: Consumers

Consumers choose whether to buy a newspaper. I assume that there is unit-demand: consumers cannot buy more than one unit of the newspaper. Moreover, in order to keep the model tractable, I assume that there is no multi-homing: when there are two newspapers, consumers can only buy one of the two. They cannot buy both newspapers at the same time. Each consumer has an outside option normalized to 0.[13]

I assume that there is vertical differentiation.[14] Consumers are heterogeneous with respect to their willingness-to-pay for a single attribute of the newspaper: the quality of the newspaper whatsoever the type of content.

Consumer i maximizes the following utility function:

[13] Assuming the existence of an outside good is a common assumption in discrete choice models. The distinction between the outside good and the competing products is that the price of the outside good is not set in response to the prices of the inside goods. In the absence of an outside good, consumers are forced to choose from the inside goods and demand depends only on differences in prices (Berry, 1994).

[14] Products are vertically differentiated when all consumers agree about the quality ordering of the products but differ in how much they are willing to pay for higher quality. On the contrary, products are horizontally differentiated when consumers disagree about which type of product provides them with greater utility holding prices constant.

$$V_i = \begin{cases} \gamma_i n_j - p_j, & \text{if she buys newspaper j} \\ 0, & \text{otherwise} \end{cases}$$

where p_j is the price of newspaper j, n_j is its quality and γ_i is consumer i's willingness-to-pay for quality. I assume that γ is uniformly distributed with unit density over the interval $\left[\underline{\gamma}, \overline{\gamma}\right]$: $U \sim \left[\underline{\gamma}, \overline{\gamma}\right]$.[15]

In the monopoly case, consumer i buys newspaper j iff

$$\gamma_i n_j - p_j \geq 0$$

In the duopoly case, newspaper j's ($j = 1, 2$) demand, D_j, is defined as the set of consumer types who get greater surplus from its quality-price offering than from the other firm's quality-price offering or the outside option:

$$D_j = \left\{ \gamma \sim U\left[\underline{\gamma}, \overline{\gamma}\right] : \gamma n_j - p_j \geq \gamma n_z - p_z \ \forall z = 0, 1, 2 \right\} \tag{1.1}$$

Higher types (consumers with a high γ) more strongly prefer higher-quality newspapers since they get a higher marginal benefit. They thus choose the higher-quality newspaper under duopoly. Middle types choose the lower-quality newspaper. Finally, if the market is not covered, lower types choose the outside option. Importantly here I am not assuming market coverage ex ante. The extent of consumers' heterogeneity – measured by the ratio $\frac{\overline{\gamma}}{\underline{\gamma}}$ – determines whether the market is actually covered or not. Market coverage is an endogenous outcome of the quality game, as it will appear clearly below.

1.3.2 Model Set-Up: Newspapers

Newspapers maximize their profits by choosing their price p and their quality n:

[15] Assuming that consumers type are distributed uniformly allows me to remove non-uniformity of the consumer preference distribution as a possible explanation of product positioning. With a uniform distribution, if a firm chooses to produce a certain quality, it is not because more consumers have that quality as their ideal product than any other. On the contrary, with non-uniform distributions, firms may tend to cluster around the majority customer preference ("agglomeration effect") (see e.g. Ansari *et al.*, 1994). Moreover, the uniformity assumption is convenient for deriving analytical results.

$$\max_{(n_j,p_j)} \Pi_j = \left[p_j D_j \left(\mathbf{n}, \mathbf{p}\right) - \frac{cn_j^2}{2} - S \right] \tag{1.2}$$

where S is the fixed cost for setting up a newspaper.[16] Implicitly in this profit function, I am considering advertising revenues as a per-reader proportional subsidy.[17]

Key here are the increasing returns to scale. The production cost is a quadratic function of the quality n and is given by $\frac{cn_j^2}{2}$. This cost is fixed with respect to output. The cost of producing the first newspaper is indeed high and increasing in quality – it depends on the number of journalists on staff –, but once this fixed cost has been borne, the variable cost of selling additional newspapers is limited to the cost of paper, printing and distribution, which is relatively low (see e.g. Baron, 2006; Berry and Waldfogel, 2010). Note that this quadratic production cost increases with quality at a faster rate than any agent's willingness-to-pay (consumers' utility functions are linear in quality).

1.3.3 Timing of the Game

The game proceeds as follows:

1. Newspapers simultaneously choose their product positioning n.

2. Newspapers simultaneously choose their price.

This time ordering is standard. Price can indeed often be adjusted faster than product characteristics can. Competing first simultaneously in quality before competing simultaneously in price allows newspapers to differentiate in quality in order to soften price competition. The two-stage modeling enables the existence of a pure-strategy equilibrium,

[16] This includes the annual costs that must be incurred in order to set up a newspaper (office space, equipment, printing press, etc.) and to maintain a reputation as a media outlet (e.g. one needs to have a minimal number of journalists covering core issues, etc.).

[17] I am implicitly assuming here that advertisers place the same value on all kind of readers. One could argue that depending on the demographics of the readers, advertisers may place different values for example on those who prefer soft news than on those who prefer hard news. In an extension of the model below (Section 1.3.5), I divide newspaper's content between hard and soft news. One simple way to take into account different values advertisers place on different readers is simply to assume different average tastes for hard and soft news.

when none would exist if qualities and prices were chosen simultaneously.[18]

1.3.4 Solving the Model

I compare the production choices of newspapers under monopoly and under duopoly. I do not consider the cases with more than two newspapers. That is, I assume that the set-up cost is sufficiently large ($S > \underline{S}$) so that a third entrant would suffer losses. Whether monopoly or duopoly prevails in equilibrium also depends on S. One can easily show that if S is sufficiently small ($\underline{S} < S < \overline{S}$), the second entrant can make positive profits, so that there is a duopoly. Conversely, for S sufficiently large ($S > \overline{S}$), no entry is profitable, and there is a monopoly (see Appendix Section A.5).

I solve the game by backward induction. I only consider pure-strategy equilibria. Solutions fall under two cases depending on the degree of heterogeneity of consumers' willingness-to-pay. Comparing the quality of the newspaper under monopoly (n_m^*) to the quality of the competing newspapers under duopoly (n_1^*,n_2^*), I obtain the following proposition.

Proposition 1 (Business stealing and returns to scale in news production)
Assume n_m^* is the monopoly equilibrium and (n_1^*,n_2^*) is the duopoly equilibrium. $\exists\ \underline{\lambda}, \overline{\lambda}$ such that
If $\frac{\overline{\gamma}}{\underline{\gamma}} \geq \overline{\lambda}$ (high heterogeneity of tastes), $n_1^* < n_m^* < n_2^*$ (i.e. under duopoly, one duopolist produces a lower-quality newspaper than the monopolist, and the other one a higher-quality newspaper).
If $\frac{\overline{\gamma}}{\underline{\gamma}} < \underline{\lambda}$ (low heterogeneity of tastes), $n_1^* < n_2^* < n_m^*$ (i.e. under duopoly, both duopolists produce a lower-quality newspaper than the monopolist).

Proof. See Appendix A.5 ■

The only Nash Equilibrium is an asymmetric equilibrium in which one newspaper is of higher quality than the other newspaper. Newspapers indeed always choose to differentiate because differentiation allows them to relax price competition while a symmetric equilibrium

[18] The sequential game specification has also implications for what markets a second paper enters. Specifically, I am ruling out any limit-pricing type of behavior where a first-mover positions itself to deter entry by others.

yields Bertrand competition – and zero profits – in the second stage of the game. The key point is thus to determine whether the high-quality duopolist produces a higher-quality newspaper than the monopolist. The impact of competition on the quality of newspapers depends on the degree of taste heterogeneity. Under competition, newspapers can choose between delivering a high-quality newspaper or lowering their price. They do not want to be close on quality since that leads to less market power. Prices increase both in the quality of the newspaper and in the quality differential $(n_2 - n_1)$ for both newspapers.

What is key for the result of Proposition 1 is that I do not assume market coverage *ex ante*.[19] Total reading increases – the business stealing effect decreases – with $\frac{\overline{\gamma}}{\underline{\gamma}}$. When heterogeneity is high ($\frac{\overline{\gamma}}{\underline{\gamma}} \geq \overline{\lambda}$), the market is not covered under competition. Entry expands the market and newspapers can differentiate on quality to soften price competition and increase market power. One duopolist produces a lower-quality newspaper than the monopolist, and the other one a higher-quality newspaper.

On the contrary, when heterogeneity is low ($\frac{\overline{\gamma}}{\underline{\gamma}} < \underline{\lambda}$), the market is covered under competition. There is business stealing: the second newspaper reduces the incumbent newspaper's output. Resources used on the fixed costs of news production increase and competing newspapers reduce their quality. Both newspapers under duopoly thus produce a lower-quality newspaper than the monopolist. Since there is no multi-homing, each reader is less informed than under monopoly and the social surplus is reduced.[20]

[19] The existing literature studying oligopolies in which firms sell products of different qualities often assume ex ante that the market is, or is not, covered. For example, Choi and Shin (1992) and Moorthy (1988) assume that firms do not cover the market. On the contrary, Tirole (1988) assumes that firms cover the market. To the extent of my knowledge, Wauthy (1996) is the first to provide a full characterization of quality choices, without assuming ex ante market coverage. But he assumes zero costs. On the contrary, I assume the existence of a quadratic cost function for quality.

[20] This result is in line with the findings of the literature on free entry and social inefficiency. Berry and Waldfogel (1999) quantify for example the inefficiency due to free entry in the radio market (see also Steiner, 1952). The main difference here is that while Berry and Waldfogel (1999) model the radio broadcasting industry as a homogenous-goods industry, I introduce differentiation in newpapers' characteristics and heterogeneity in consumers' willingness-to-pay for these characteristics. When heterogeneity is not high enough, then the social inefficiency result holds.

1.3.5 Extension: Hard vs. Soft News

In this extension of my simple theoretical framework, I divide newspaper content between hard news (h) and soft news (s). Consumers are heterogeneous with respect to their willingness-to-pay for these two attributes of newspapers. Consumer i maximizes the following utility function:

$$V_{ij} = \begin{cases} \theta_i h_j + \alpha_i s_j - p_j, & \text{if she buys newspaper j} \\ 0, & \text{otherwise} \end{cases}$$

where h_j is the quality of hard news produced by newspaper j, s_j the quality of soft news, and p_j the price.

θ_i is consumer i's willingness-to-pay for high-quality hard news. It is uniformly distributed with unit density over the interval $\theta \sim U\left[\underline{\theta}, \overline{\theta}\right]$. Similarly, α_i is consumer i's willingness-to-pay for high-quality soft news and $\alpha \sim U\left[\underline{\alpha}, \overline{\alpha}\right]$. I assume that θ and α are mutually independent.

Newspapers maximize their profits by choosing their price p, the quality of hard news h and the quality of soft news s:

$$\max_{(h_j, s_j, p_j)} \Pi_j = \left[p_j D_j \left(\mathbf{h}, \mathbf{s}, \mathbf{p}\right) - \frac{c_h h_j^2}{2} - \frac{c_s s_j^2}{2} - S \right]$$

where the production cost of hard news is given by $\frac{c_h h_j^2}{2}$ and the production cost of soft news by $\frac{c_s s_j^2}{2}$. As before I assume that these costs are quality-dependent fixed costs.[21] Following the general case, newspapers first choose their product positioning (h and s) and then simultaneously compete in price.

I allow more heterogeneity in the tastes for one attribute (say soft news) than for the other attribute (say hard news). A simple way to do it is to assume that $\theta_i = \theta \, \forall i$. Everything

[21] To be consistent with the general case of the model, I am assuming here that consumers differ *vertically* in their preferences for hard and soft news. However combining heterogeneity in the willingness-to-pay for newspaper quality with *horizontal* differentiation in the tastes for hard news and soft news will deliver similar predictions.

else is assumed to be symmetrical. The average taste for hard and soft news is the same: $\theta = \frac{\underline{\alpha}+\overline{\alpha}}{2}$. The cost of producing hard and soft news is also identical: $c_h = c_s$.

To increase tractability, I only present results in a discrete setting (however there are robust to a continuous setting). h and s can only take two values: a low value ($\underline{h}$, $\underline{s}$) and a high value ($\overline{h}$, $\overline{s}$). I assume that $\left[\underline{h}, \overline{h}\right] = [\underline{s}, \overline{s}]$. There is no cost of producing a low value of hard or soft news, and a cost $c > 0$ of producing a high value. There are 4 possible strategies for the newspaper:

1. $(\underline{h}, \underline{s})$ (cost = 0);
2. $(\underline{h}, \overline{s})$ (cost = c);
3. $\left(\overline{h}, \underline{s}\right)$ (cost = c);
4. $\left(\overline{h}, \overline{s}\right)$ (cost = 2c).

Monopoly Consider first what happens in the monopoly case. Comparing the profits in the 4 possible cases leads to Lemma 1:

Lemma 1 (Monopoly)

As the production cost increases, a monopoly newspaper first cuts on soft news and then cuts on hard news. That is, the monopoly chooses:

$$(h_m^*, s_m^*) = \begin{cases} (\overline{h}, \overline{s}) \;\; if \;\; c < c_1^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(M1)} \\ (\overline{h}, \underline{s}) \;\; if \;\; c_1^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) < c < c_2^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(M2)} \\ (\underline{h}, \underline{s}) \;\; if \;\; c > c_2^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(M3)} \end{cases}$$

Proof. See Appendix A.5 ■

Two things have to be highlighted. First, it is never optimal for the monopoly to choose $(\underline{h}, \overline{s})$. Second, the value of hard and soft news provided by the monopoly depends on the degree of taste heterogeneity $\frac{\overline{\alpha}}{\underline{\alpha}}$. The cost thresholds $c_i^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha})$ $(i = 1, 2)$ are functions of $\frac{\overline{\alpha}}{\underline{\alpha}}$ and $\frac{\overline{s}}{\underline{s}}$. For a given ratio $\frac{\overline{s}}{\underline{s}}$, the more heterogeneity in tastes $\frac{\overline{\alpha}}{\underline{\alpha}}$, the higher the threshold cost

$c_1^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha})$ and the lower $c_2^m(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha})$. That is to say, for a given $\frac{\overline{s}}{\underline{s}}$, a higher heterogeneity $\frac{\overline{\alpha}}{\underline{\alpha}}$ increases the chances of soft news being low and hard news being high.

Duopoly Lemma 2 is obtained by computing the best response functions of each newspaper and solving for the Nash equilibrium.

Lemma 2 (Duopoly)

For all production costs, newspapers under duopoly specialize along the soft news dimension. That is, competing newspapers choose:

$$(h_1^*, s_1^*), (h_2^*, s_2^*) = \begin{cases} (\overline{h}, \underline{s}), (\overline{h}, \overline{s}) \;\; \textit{if} \;\; c < c_1^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(D1)} \\ (\underline{h}, \underline{s}), (\underline{h}, \overline{s}) \;\; \textit{if} \;\; c_1^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) < c < c_2^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(D2)} \\ (\underline{h}, \underline{s}), (\overline{h}, \overline{s}) \;\; \textit{if} \;\; c > c_2^d(\underline{s}, \overline{s}, \underline{\alpha}, \overline{\alpha}) & \text{(D3)} \end{cases}$$

Proof. See Appendix A.5 ■

Regardless of where the other newspaper is located, each newspaper's best product strategy is always to differentiate on at least one dimension. Newspapers always differentiate along the dimension with the greater heterogeneity, here soft news: if one newspaper chooses to produce $\underline{s}$, the other newspaper's best product strategy is always to produce $\overline{s}$. One can think of the attribute with more heterogeneity as playing the same role as the single dimension. Firms differentiate along this attribute to relax price competition. The role of the second attribute is different. Newspapers use this attribute to manage demand and cost considerations. If the production cost is low (equation (D1)), both newspapers produce a high value of hard news $\overline{h}$ (since it is not costly for them to do so). When the production cost increases above c_1^d (equation (D2)) then newspapers choose to offer a low value of information $\underline{h}$ to contain costs. Finally, when the cost increases above c_2^d (equation (D3)), it becomes optimal for newspaper 2 to sell to high-end consumers only to alleviate price competition. In this case, newspapers exploit both dimensions to differentiate.

Monopoly vs. duopoly Combining together the results for the monopoly and the duopoly case, I obtain the following proposition:

Proposition 2 (Specialization effect)

There is an intermediate cost interval $[\tilde{c}, \hat{c}]$ s.t. $\forall c \in [\tilde{c}, \hat{c}]$ both newspapers under duopoly produce less hard news than the newspaper under monopoly:

1. ***Monopoly**: $(h_m^*, s_m^*) = (\overline{h}, \underline{s})$.*

2. ***Duopoly**: $(h_1^*, s_1^*), (h_2^*, s_2^*) = (\underline{h}, \underline{s}), (\underline{h}, \overline{s})$.*

Proof. See Appendix A.5 ■

1.3.6 Corollary Prediction: Political Participation

Proposition 1 shows how newspaper quality varies with the number of newspapers and how this effect depends on the extent of heterogeneity. When heterogeneity is low, an increase in the number of newspapers leads to a decrease in the quality of the two competing newspapers. If more informed voters are more likely to vote (see e.g. Parlfrey and Poole, 1987; Banerjee *et al.*, 2010; Campante and Do, 2013), then an increase in competition leads to a decrease in political participation.[22]

Proposition 3 (Media competition and political participation)

Assume consumers differ in their willingness-to-pay for quality.

When heterogeneity in the willingness-to-pay for quality is high, newspaper entry leads to an increase in turnout at elections.

When heterogeneity in the willingness-to-pay for quality is low, newspaper entry leads to a decrease in turnout at elections.

[22] I assume that people learn information for their voting decision as a by-product of newspaper readership. An important number of studies have indeed shown that people often learn politically relevant facts as a by-product of nonpolitical routines (Prior, 2007). As underlined by Hamilton (2004):*"The small chance that an individual reader's political action can influence events makes it unlikely he or she will search out the information helpful in making a voting decision."* (p.2) .

In the Appendix to this paper (Section A.6) I combine Proposition 1 with a voting model to formalize this prediction.

1.3.7 Summary: Empirical Predictions

The simple theoretical framework above generates three testable predictions that I bring to the data:

1. **Newspaper quality**: if heterogeneity in the willingness-to-pay for quality is low, newspaper entry leads to a decrease in the quality of the two competing newspapers compared to the monopolist.

2. **Type of news produced** (extension): if the heterogeneity in the willingness-to-pay for hard news is lower than the heterogeneity in the willingness-to-pay for soft news, newspaper entry leads to a decrease in the quality of hard news produced by the two competing newspapers compared to the monopolist.

3. **Voter turnout**: if heterogeneity in the willingness-to-pay for quality is low, newspaper entry leads to a decrease in voter turnout at elections.

Before testing these predictions, I describe the French local daily newspaper industry and present the new dataset I build for this study.

1.4 Industry and Data Characteristics

As stated in the introduction, the French local daily newspaper industry is particularly interesting to study because of the importance of this industry and the availaility of high-quality data. I construct an annual dataset on the evolution of the French newspaper market between 1945 and 2012. Section 1.4.1 discusses basic industry characteristics and presents its historical development. Section 4.3 reviews the dataset. Finally Section 1.4.3 describes my empirical measures to proxy for heterogeneity in consumers' willingness-to-pay for quality.

1.4.1 Industry Characteristics and Historical Development

My sample includes 264 local daily newspapers over the 1945-2012 period. These newspapers are general information newspapers that offer a mix of soft and hard news topics. On average, about two thirds of the space in these newspapers is devoted to soft news (one third to hard news) but this mix can vary widely (Table 1.1 presents descriptive statistics on newspapers' content). The average newspaper issue contains 421 articles of relatively small length (286 words per article). The size of newspapers is one of my proxies for quality. The other proxy I use is the number of journalists on staff. On average, 201 journalists work in each newspaper (Table 1.2 provides descriptive statistics on papers' costs and revenues).

Overall, the local daily newspaper industry generates €2.515 billion ($3.424 billion) in total revenues in 2012, three times more than the national daily newspaper industry (€687 million). It represents nearly 30% of the total revenues generated by the print media industry (€8.705 billion[23]). 63% of theses revenues come from sales and 37% from advertisement. Its total circulation is around 5.5 million copies a day, compared to 1.5 million for the national daily newspaper industry.

To get a sense of how important these circulation numbers are, it is useful to present them in terms of market penetration. The natural news market for a local daily newspaper in France is a county[24]; there are 90 counties in metropolitan France excluding the area of Paris.[25] On average, there are 2.67 newspapers per county and the total newspaper circulation in a county is $80,981$ copies which represents 24% of the eligible voters (see Table

[23]I.e. $11.850 billion or 0.43% of the GDP. In comparison, according to the Newspaper Association of America, the US newspaper media industry generates $38.6 billion in total revenues in 2012 (0.25% of the GDP).

[24]A county ("département" in French) is a French administrative division. The median land area of a county is 2,303 sq mi, which is slightly more than three-and-half times the median land area of a county in the United States. In 2010, excluding Paris, the median population of a county is 478,366 inhabitants and the median number of eligible voters is 350,658. (French local jurisdictions are described in more details in the Appendix section A.1).

[25]In my analysis, I exclude the Paris area. In this area, local daily newspapers are indeed competing in a different way with national newspapers. Paris having a national dimension, a lot of "local" information concerning the area of Paris is covered in national newspapers. Then there is much more competition between the different newspapers than in the rest of France and considering only competition between local newspapers would be misleading.

Table 1.1: *Summary Statistics of Newspapers' Content*

	mean/sd	mean/sd	mean/sd
Number of words per front page	370		
	(222)		
Number of articles in the newspaper		421	
		(302)	
Number of words in the newspaper		107044	
		(83165)	
Average article length		286	
		(40)	
Share of articles on hard news			34.8
			(13.4)
Share of articles on soft news			66.5
			(11.5)
Share of words on hard news			32.7
			(13.9)
Share of words on soft news			68.6
			(11.9)
Newspaper specialization (Herfindhal Index)			0.17
			(0.13)
Observations	94,901	30,503	28,180

Notes: The table gives summary statistics for newspapers' content. It presents the average and the standard deviations (between parentheses) of the variables. Variables are values for newspapers. Time period is 2005-2012. The share of articles on hard news is defined as the number of articles on agriculture, economics, education, environnement, international or politics, divided by the total number of articles I classify. The share of articles on soft news is defined as the number of articles on movies, culture, leisure activities, sports, "news in brief", religion or health, divided by the total number of articles I classify. Newspaper specialization is an Herfindahl index of newspaper differentation. The Herfindahl index is equal to the sum of the squares of the shares of the different newpaper topics in each newspaper issue: agriculture, culture, economics, education, environnement, health, international, leisure activities, movies, "news in brief", politics religion and sports.

Table 1.2: *Summary Statistics of Newspapers' Costs and Revenues*

	1960-2009 mean/sd	**1999-2012** mean/sd
Profits	974	
	(37,973)	
Total Revenues	44,339	
	(64,426)	
Revenues from Sales	25,627	
	(49,092)	
Advertising Revenues	16,893	
	(22,146)	
Total Expenses	43,052	
	(55,440)	
Expenses on Labor (Payroll)	24,815	
	(25,198)	
Expenses on Intermediate Goods (Inputs)	32,236	
	(36,362)	
Number of Employees	432	
	(407)	
Number of Journalists		201
		(123)
Share of Journalists in Employees		0.36
		(0.20)
Observations	2,169	353

Notes: The table gives summary statistics for newspapers' revenues, expenses and number of employees and journalists. It presents the average and the standard deviations (between parentheses) of the variables. Variables are values for newspapers. All variables (excepted the number of employees and journalists) are in (constant 2009) thousand euros. Time period is 1960-2009 for all the variables excepted the number of journalists (1999-2012).

1.3 which presents summary statistics on newspaper circulation). Given that the average ratio of reported readership to circulation is 2.93, this implies that more than 70% of the egilible voters in a county read a local daily newspaper. Hence the issue of how changes in the news market structure affect the provision of information by daily local newspapers is key. Although there is a downward trend in circulation over the period 1945-2012, the total circulation of local newspapers has always been extremely large. The number of copies sold everyday ranges from 20 to 30% of the eligible voters during my period of interest.[26]

Given the importance of circulation across nearby counties – between 1945 and 2012, 42% of the local daily newspapers circulate in more than one county, and these newspapers circulate on average across 4 counties[27] – my main variables of interest are at the newspaper-county level.

Newspaper entries and exits The central independent variable in my analysis is the change in the number of newspapers. My sample includes 630 newspaper-county pairs. I observe a total of 276 county-years with net newspaper entry and 361 county-years with net newspaper exit. Figure A.11 shows for each year the number of counties with net newspaper entry (upper figure A.11a) and the number of counties with net newspaper exit (bottom figure A.11b). The high number of entries and exits between 1945 and 1955 comes from the Second World War. The wartime period marks an almost wholly clean break with the prewar media system, with the press industry effectively rebuilt from scratch once the conflict is over.[28] When I exclude this post-war period (1945-1954), I am left with a total of 79 county-years with net newspaper entry and 222 county-years with net newspaper

[26]See the Appendix Figure A.16.

[27]More detailed summary statistics on the circulation of newspapers across counties are available in the Appendix Section A.2.

[28]In the immediate postwar period, newspapers accused of collaboration with the Nazi occupiers are closed down and their assets redistributed to owners untainted by collaboration. While the old prewar press groups are eliminated, a new press system is reconstituted from independent companies. Of the 206 (local and national) daily newspaper titles that had been published in France in 1939, only 28 are able to resume operations after the war (Guillauma, 1988).

Table 1.3: *Summary Statistics of Newspapers' Circulation*

	1945-2012 mean/sd	**1945-2012** mean/sd	**1945-2012** mean/sd	**1959-2011** mean/sd
County-level variables				
Total County Circulation (# copies)	79,454			
	(82,554)			
Total County Circulation per eligible voter (%)	0.24			
	(0.12)			
Average Number of Newspapers in a County	2.69			
	(1.51)			
Newspaper*county-level variables				
Newspaper Circulation per county (# copies)		29,784		
		(38,457)		
Newspaper Circulation per county and eligible voter (%)		0.09		
		(0.08)		
Newspaper-level variables				
Total Circulation (# copies)			82,106	
			(118,691)	
Ratio of Readership to Circulation				2.86
				(1.65)
Observations	5,866	11,994	6,092	2,117

Notes: The table gives summary statistics for newspapers' circulation. it presents the average and the standard deviations (between parentheses) of the variables. For circulation, time period is 1945-2012. For readership, time period is 1959-2011.

exit.[29] The entering newspapers are either new newspapers entering the newspaper market from scratch (in 24% of the cases[30]) or existing newspapers entering a neighboring market. Importantly, in more than 76% of the cases, newspapers on a given market are owned by different owners. This share increases to 80% when considering markets with only two newspapers.

Given that entries and exits are key for my identification strategy, it is critical to understand the forces that cause them. The existing literature suggest two primary determinants of the number of newspapers in a market (see e.g. Gentzkow *et al.*, 2011). The first is population. As I underline above, newspapers have fixed costs, so market size is a major determinant of the number of newspapers in a market (Bresnahan and Reiss, 1991; Berry, 1992). In the Appendix Table A.5, I provide evidence that, on the one hand, the market size is a good predictor of the number of active newspapers, and that on the other hand, newspapers move in where there is a trending population. The second determinant of the number of newspapers is income; richer counties can command both greater consumers' willingness to pay for newspapers and marketability to advertisers. For the recent period 2003-2010, I have county-level annual data on the total income tax revenue collected by the government.[31] This proxy for income is significantly and positively correlated with the number of newspapers.

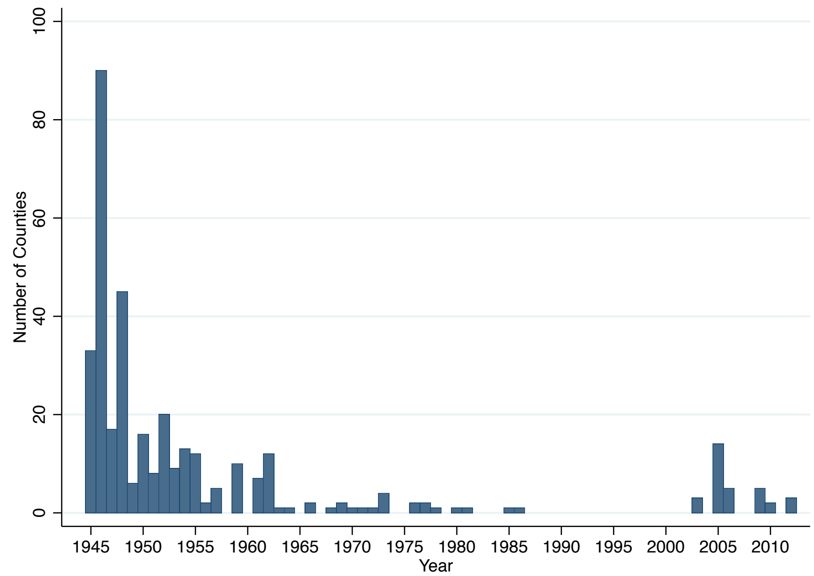
1.4.2 Data

In this section, I briefly describe the dataset I have constructed for this paper. I discuss further details of the construction of the data in the Appendix (section A.1). Those readers who feel uninterested by these technical details may want to go directly to Section 1.4.3.

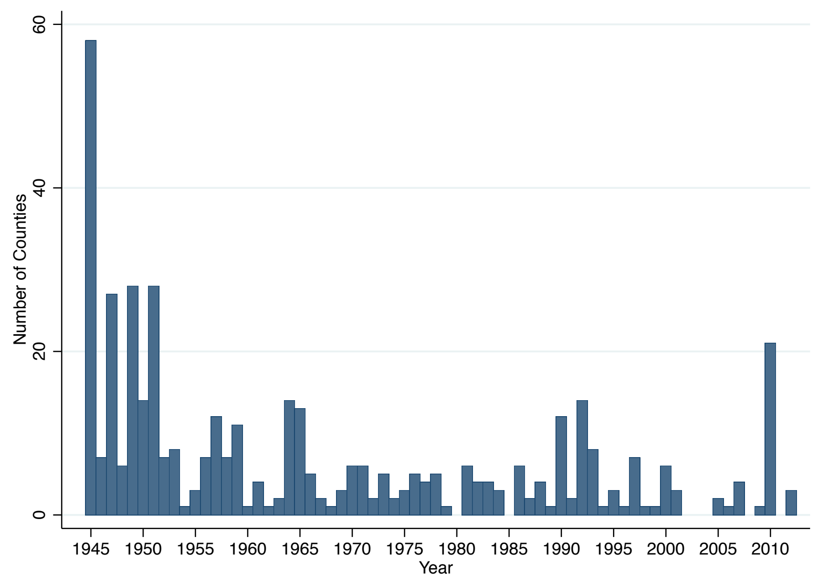
[29]Section A.2 in the Appendix presents a more detailed overview of this data.

[30]65 out of the 276 county-years with net newspaper entry I observe come from this new newspapers. Among these 65 cases, 51 are caused by new newspaper owners entering the local daily newspaper industry.

[31]This data is from the Finance Ministry.



(a) *Number of Counties with Net Entry*



(b) *Number of Counties with Net Exit*

Notes: The figure shows for each year the number of counties with net newspaper entry (upper figure A.11a) and the number of counties with net newspaper exit (bottom figure A.11b).

Figure 1.1: *Number of Counties with Net Newspaper Entry / Net Newspaper Exit by Year*

Newspaper circulation, costs and revenues To determine for each year between 1945 and 2012 the number of newspapers present in each French county, I use various sources of information (e.g. official registries) that I digitize and merge. I count local daily newspapers from these sources: in each year, I extract the name and the counties in which every local daily newspaper circulates. I match newspapers across time using their title and counties. For each county-year, I also compute the number of local daily newspapers which serves as my key explanatory variable.

For the period 1945-1990, newspaper circulation data comes from official data I digitize and merge. Data for recent years (1990-2012) comes from the French press observatory. I collect annual data on newspaper readership between 1957 and 2011 from studies on French newspaper readers principally conducted for the advertising market. These surveys cover, for each newspaper, information on its aggregate readership.

I compute annually for local daily newspapers between 1960 and 2009 a number of important economic indicators, namely sales, profits, value-added, operating expenses (on intermediate goods and labor), operating revenues (revenues from sales and revenues from advertising) and the number of employees. This dataset is, to the extent of my knowledge, the most complete existing dataset on newspapers' costs and revenues. I collect data covering the period 1960-1974 from the archives of the Ministry of Information. Between 1960 and 1974, French newspapers were asked by the Ministry of Information to report annually on circulation, expenses, revenues and profits. From 1984 to 2009[32], the data comes from the Enterprise Survey of the French national institute for statistics. I identify newspapers in the dataset using the French registry of establishments and enterprises. For the newspapers not covered in the Enterprise Survey, I use information from the Bureau van Dijk's websites (in particular ORBIS). For 24 newspapers between 1999 and 2012, I also collect information on the number of journalists. The correlation between the total number of employees and the number of journalists is equal to 0.94 and is statistically significant at the 1% level. Finally I collect price data for my entire sample of newspapers between 1960

[32]Unfortunately, no data is available for the period 1975-1983.

and 2012.

Given that my analysis is at the newspaper-county level, I need to construct newspaper-county-level values of the variables. This is simple when the only newspapers circulating in a county are headquartered in this county and do not circulate outside. It is more problematic when a newspaper circulates across nearby counties. In this case, I use data on the geographical dispersion of circulation; for each newspaper, I assign to the counties in which it circulates a percentage of the value of the variable (e.g. total sales, operating expenses,...) equal to its share of the newspaper circulation.

Newspaper content I supplement this data for recent years with measures of newspaper content, in particular of the size of newspapers. I use three different measures of size. First, for each newspaper issue, I count the number of words by front page. Front pages are available daily for 51 newspapers over the period 2006-2012. I download them from the local daily press syndicate website using an automated script.[33]

Second, I collect data on the entire daily content of each newspaper by using an automated script to retrieve for each day all the articles published in the newspaper. I download the data from two different websites which aggregate content from newspapers (Factiva and Lexis-Nexis). I construct a dataset covering 22 different newspapers over the period 2005-2012 with information on the total number of articles and the total number of words per issue.[34]

I next use the metadata (tag) associated with each article on Lexis-Nexis (title, subject, topic) to classify articles as hard news or soft news. The share of articles on hard news is defined as the number of articles on agriculture, economics, education, environnement, international or politics, divided by the total number of articles I am able to classify. The share of articles on soft news is defined as the number of articles on movies, culture, leisure

[33] Using front pages is not new in the literature. To establish evidence of media capture, DiTella and Franceschelli (2011) construct an index of how much first-page coverage of the four major newspapers in Argentina is devoted to corruption scandals.

[34] Berry and Waldfogel (2010) also use the size of the paper to measure quality, but they measure it with the number of pages, not with the number of articles per issue.

activities, sports, "news in brief" (*faits divers*), religion or health, divided by the total number of articles I am able to classify.[35] (More details on the classification of articles between hard and soft news are presented in Section 1.5.5.)

Finally, I use the article classification in sub-categories to construct a measure of newspaper differentiation. This measure is an Herfindhal index ranging from 0 – no specialization, i.e. no differentiation between newspapers that all deal with all the topics – to 1 – perfect newspaper specialization, i.e. important newspaper differentiation, each newspaper being specialized in a given topic (e.g. music or sport). This index is equal to the sum of the squares of the shares of the different newpaper topics in each newspaper issue.

Electoral data and demographic controls I focus on mayoral (city-level) elections. As of today, there are 36,570 cities in metropolitan France. There are 2,282 cities with more than 3,500 inhabitants outside the area of Paris. In this paper I focus on these cities over 3,500 inhabitants since the electoral rule for mayoral elections for cities under 3,500 inhabitants is different. For each election, I measure turnout as the ratio of cast votes to eligible voters. I use cast votes rather than total votes since in France blank votes are not included in turnout. Mayoral elections take place in France every six years. Between 1945 and 2012, 11 elections took place: 1947, 1953, 1959, 1965, 1971, 1977, 1983, 1989, 1995, 2001 and 2008.[36] Before 1983, data on French mayoral elections have never been digitized. I construct the first electronically available dataset on French local elections results at the city level between 1945 and 1982, using official data sources in paper format. More recent data are available in digitized format from the *Centre de Données Socio-Politiques* (CDSP) of Science-Po Paris, the Interior Ministry, and Bach (2011). On average over the period, the turnout rate is equal to 67%.[37]

[35]By construction, the sum of both shares is equal to 100.

[36]A mayoral election also took place in 1945. I choose not to include it in the dataset since this election took place before the end of the Second World War in very special conditions and just two years before the 1947 election.

[37]In the Appendix Figure A.17, I show the evolution of the turnout rate between 1947 and 2008.

City-level demographic data from the French census is available in electronic format from 1960 to 2012. I digitize data for the 1936, 1946 and 1954 censuses from original publications by the French national institute for statistics. I compute the share of the population by age group (1945-2012), occupation and degree (1960-2012). For each measure, I interpolate both the numerator and denominator between census years using a natural cubic spline (Herriot and Reinsch, 1973) and divide the two to obtain an estimate of the relevant share.

1.4.3 Measures of Heterogenity

The most novel feature of my simple theoretical framework is that the effect of entry depends on the extent of heterogeneity in consumers' willingness-to-pay.

Heterogeneity in the willingness-to-pay for quality While the model yields a precise measure of heterogeneity $\left(\frac{\overline{\gamma}}{\underline{\gamma}}\right)$, the choice of the data to quantify the extent of heterogeneity in the willingness-to-pay for quality across counties is more problematic. If data on the income distribution of individuals within each county were available, I could have used the dispersion of this distribution as my measure of county-level heterogeneity.[38] The income distribution follows a Pareto distribution and one can estimate the slope of the distribution using regression techniques. However, income data at the county level is only available since 2003 and, moreover, it is aggregated into 6 different categories, precluding such an estimation of the dispersion. Nevertheless, I can compute an heterogeneity measure by using the distribution of individuals across socio-economic groups. Individuals (the working population between 15 and 64 year old) in the census are indeed classified into $n = 6$ different socio-economic groups[39] and the data is available since 1960. Following the

[38] Tirole (1988) shows for example that γ can be viewed as the inverse of the marginal rate of substitution between income and quality rather than as a taste parameter. As far as the choice between buying and not buying is concerned, the consumer's preferences could be read as $V_{ij} = n_j - \frac{1}{\gamma_i} p_j$. On this interpretation, all consumers derive the same surplus from the newspaper, but they have different incomes and therefore, different marginal rates of substitution between income and quality $\frac{1}{\gamma_i}$. Wealthier consumers have a lower "marginal utility of income" or, equivalently, a higher γ.

[39] (i) Farmers; (ii) Artisans, shopkeepers and company managers (*"artisans-commercants-chefs d'entreprises"*); (iii) Senior executives and knowledge workers (*"cadres et professions intellectuelles supérieures"*); (iv) Intermediate

existing literature, the heterogeneity measure I use is one minus the Herfindahl index of the share of the socio-economic groups (see e.g. Alesina *et al.*, 2012):

$$Heterogeneity_{ct} = 1 - \sum_{i=1}^{n} p_{ict}^2$$

where p_{ict} is the share of the population from socio-economic group i in county c and year t. $Heterogeneity_{ct}$ increases when the evenness of the distribution of the individuals among the different categories increases. It gives us the probability that two randomly selected individuals in a county belong to two different socio-economic groups.

I compute the heterogeneity measure for each county for the first year for which I have socio-economic group data in the census, namely 1960 (this also corresponds to the first year for which I have data on newspapers' revenues and expenses). Using the median over all the counties, I then split my sample of counties between low-heterogeneity and high-heterogeneity counties. Given the fact that in the model the results depend on whether a county is below or above a heterogeneity threshold, such a binary measure of heterogeneity is more relevant than a continuous measure. I compute this measure at the beginning of the time period rather than on an annual basis to avoid any endogeneity issue.

Importantly, this measure of heterogeneity is not correlated with county size. However, low- and high-heterogeneity counties differ in terms of other demographic covariates. In the Appendix Table A.3, I perform a t-test on the equality of means for education, socio-economic groups, age, total population and the number of newspapers of high- and low-heterogeneity counties. I find that low-heterogeneity counties have a higher proportion of low-educated people (who only achieve elementary primary school), a higher proportion of farmers and of laborers, and a higher proportion of individuals below 20 years old.

Relative heterogeneity in the willingness-to-pay for hard and soft news Finally, to bring to the data the prediction of the extended case of my simple theoretical framework, I need

occupations (*"professions intermédiaires"*); (v) Employees; (vi) Laborers. In the Appendix Figure A.18 I show the evolution of the socio-economic composition of France between 1960 and 2012.

to quantify the relative heterogeneity in the willingness-to-pay for hard news and for soft news. As I underline above, higher heterogeneity in the tastes for soft news may come from the fact that soft news has more dimensions than the political space. I proxy heterogeneity in the willingness-to-pay for hard news with a measure of political polarization. Using electoral results for the 2002 presidential election (the last election which takes place before 2005 – the first year for which I have newspaper's content data), I construct for each county the share of the votes for extreme-right and extreme-left parties. My assumption is that the higher this share, the higher the heterogeneity in the willingness-to-pay for hard news. The next section studies empirically the impact of an entry on the quality of newspapers.

1.5 Newspaper Competition and News Quality

In this section, I test the predictions of the simple theoretical framework described in Section 1.3 (proposition 1) and of its extension (proposition 2). I study how newspaper quality varies with the market structure and interact the effect of the market structure with the degree of heterogeneity in consumers' willingness-to-pay. To measure empirically the vertical quality attribute of newspapers, I first use the total number of employees; as I show above, this number is strongly correlated with the number of journalists on staff. The advantage of this measure is that it allows me to use the panel dimension of the dataset to exploit the timing of entries and exits for identification. My second proxy for quality is "quantity" – the size of newspapers. More content is indeed presumably always preferred to less by consumers. I use quantity to estimate both the impact of competition on newspaper quality and on the type of news produced – hard versus soft news. I perform this analysis taking a reduced-form approach to shed light on whether the empirical results are consistent with the predictions of my theoretical framework. I use all the variations in the data from $n > 0$ to $n + 1$ newspapers.

1.5.1 Empirical Strategy

The main empirical challenge is to isolate the impact of entries and exits on incumbent newspapers. My identification strategy relies on the timing of these events. I estimate the effect of the entry (or exit) of a newspaper by comparing counties that experience an entry (or exit) to similar counties in the same year that do not. Because the entry decision is made to maximize profits, counties that experience an entry are likely to differ from other counties, both at the time of entry and in future periods. The identifying assumption is that newspapers in these other counties form a valid counterfactual for the incumbent newspapers in counties that experience an entry, after conditioning for differences in pre-existing trends, newspaper fixed effects, year fixed effets, and a large set of demographic covariates controlling for the age composition, occupational structure and educational level of counties, as well as for the circulation of national newspapers. I provide below evidence that entries are orthogonal to the outcomes I study: there are no pretrends in circulation, revenues, expenses and the number of employees before entries (Section 1.5.2).[40] Given the existence of treatment and control counties with a common underlying trend, I can quantify the entry effect that induces a sharp deviation from this trend. As underlined above, between 1945 and 2012, I observe a total of 276 county-years with net entry and 361 county-years with net exit, and of 79 county-years with net entry and 222 county-years with net exit when I drop the postwar period.

1.5.2 Results: Market Expansion or Business Stealing?

According to the simple theoretical framework I propose, the entry of a newspaper on a market may have a negative impact on incumbent newspapers if there is business stealing: the total circulation of the entrant exceeds the increase in the news market total circulation. To estimate whether it is the case, I use my panel data on newspaper competition and track

[40]Orthogonality may come from the fact that, in the spirit of a latent variable model with threshold crossing, small increases in population create a discontinuity. While entry is discontinuous, demographic charateristics indeed change smoothly.

the impact of a change in competition on newspapers' circulation. I study how a change in the number of newspapers in a county affects (i) the circulation of incumbent newspapers (per eligible voter) in the county; and (ii) the total newspaper circulation (per eligible voter) in the county. I estimate alternatively an aggregate event studies and a fixed-effect model that allows for time-varying effects of entries and exits.

Aggregate event studies The event of an entry (alternatively an exit) is the cross-sectional dimension and the years around the event are the temporal dimension of my panel. In the case of an entry, incumbent newspapers are defined as the newspapers circulating in the county the year before the entry. I study how the circulation of these newspapers is affected by the introduction of a new newspaper. Business stealing corresponds to a decrease in the circulation of incumbent newspapers. In the case of an exit, incumbent newspapers are defined as the newspapers circulating in the county the year before the exit *excepted* the newspaper which exits. The exit of a newspaper should either increase or not affect the circulation of incumbent newspapers. The analysis is robust to summing the variables of interest over incumbent newspapers or to consider each incumbent newspaper separately (in which case the cross-sectional dimension is the interaction of an event and a newspaper). I present here the results using the sum over incumbents.

I study the effect of newspaper entry and exit separately since the impact of entry and exit on circulation may not be symmetrical.[41] One of the main reason why it may not be symmetrical is the life cycle of newspapers. Newspapers enter large but exit small. On average circulation in the year of entry is equal to 116% of a newspaper's lifetime average circulation; circulation in the last year before exit is equal to 75% of the lifetime average.

Newspaper entry I consider first newspaper entry. Let c index counties, e index entry events, t index calendar years and j index event periods. By normalization, entry takes place

[41] There are some episodes during which there are simultaneously one (or more) entry(ies) and one (or more) exit(s) in a given county a given year. When entry(ies) and exit(s) cancel out I drop the episode. My results are robust to either considering as entries the episodes during which there are more entries than exits (net entry) or to dropping them. Similarly, they are robust to either considering episodes of net exit as exit or dropping them. Additional details on the construction of the episodes are available in the Appendix Section A.1.

in $j = 0$. The outcome of interest, $circulation_{cte}$, is the (aggregate) circulation of incumbent newspaper(s) per eligible voter.

I estimate the following model:

$$circulation_{cte} = \sum_{k=-10}^{+10} \alpha^k \mathbf{1}_{\mathbf{cte}}^{\mathbf{j=k}} + \mathbf{X}_{\mathbf{ct}}^{'}\delta + \gamma_t + \eta_c + \varepsilon_{cte} \tag{1.3}$$

where γ_t are year fixed effects, η_c county fixed effects, and ε_{cte} is the error term. The vector of controls $\mathbf{X}_{\mathbf{ct}}^{'}$ includes the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in county c and year t. Standard errors are clustered by events.

The set of coefficients α^k are my coefficients of interest.[42] In Figure 1.2, I first plot these coefficients α^k for the entire period 1945-2012 and without controls. The dependent variable is total circulation (per eligible voter) in the upper figure (Figure 1.2a) and the circulation of incumbent newspapers (per eligible voter) in the bottom figure (Figure 1.2b). Two things need to be underlined. First, whether I consider total county circulation or circulation of incumbent newspapers, there is no pretrend before the entry. All the α^k coefficients before the event are not statistically significant and the point estimates are close to zero. Second, despite the fact that there is some market expansion – the total circulation per capita increases by around 4 percentage points (Figure 1.2a) –, we observe a strong and permanent business stealing effect (Figure 1.2b). The circulation of incumbent newspapers per eligible voter decreases by around 7 percentage points after entry, which corresponds to a 26% decrease.[43]

According to my simple theoretical framework (proposition 1), the business-stealing effect should be especially strong in low-heterogeneity counties. In Figure 1.3, controlling for demographics (education, socio-economic groups and population) and focusing on the

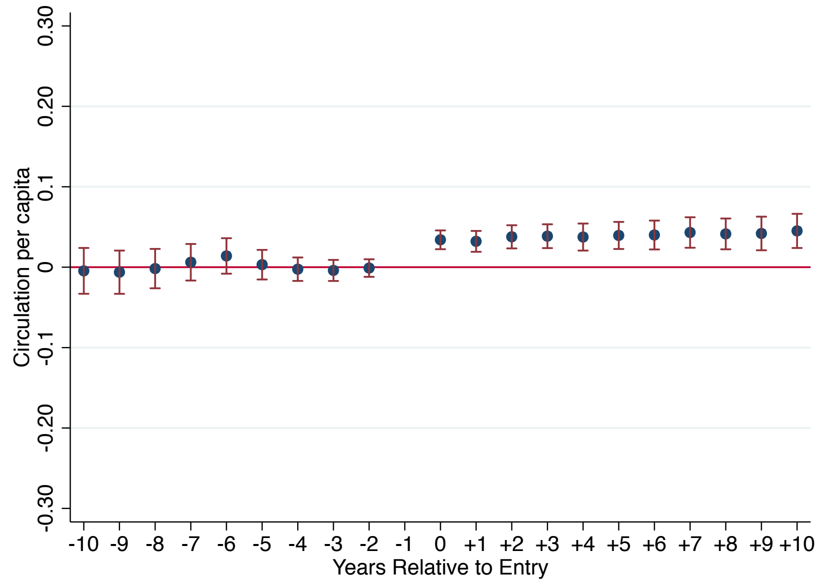
[42]Years around the event go from -10 to $+10$ but results are robust to the use of other time intervals. Results are also robust to estimating the model in first differences rather than in level.

[43]Between 1945 and 2012, the average circulation of incumbent newspapers per eligible voter the year before an entry is 26.92%.

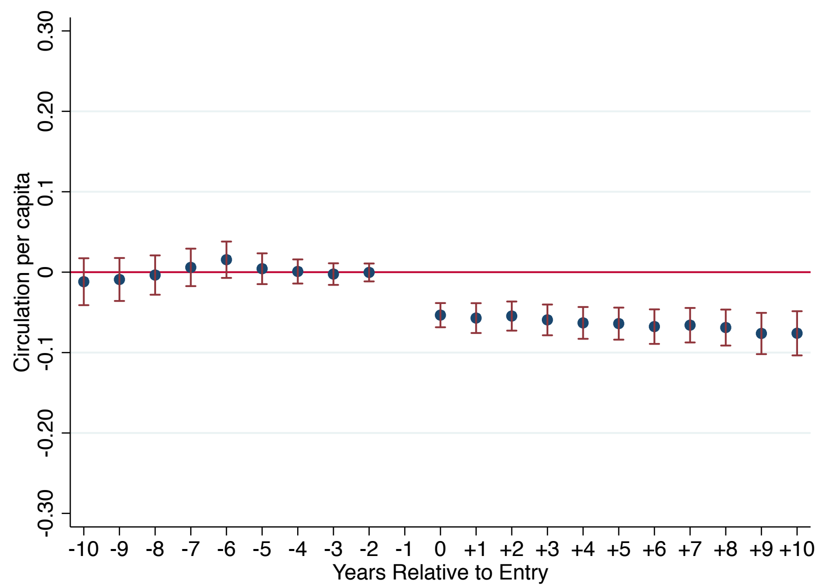
1960-2012 period, I investigate the effect of entry separately for low- and high-heterogeneity counties. It appears clearly that the business-stealing effect is much more important in low than in high-heterogeneity places. In low-heterogeneity counties, there is no market expansion after an entry (Figure 1.3a). There is a negative impact on the circulation of incumbent newspapers at the time of entry, and this impact becomes stronger in the years following the entry. 8 years after the entry, we observe a 10 percentage points decrease in the circulation of incumbent newspapers per eligible voter, which corresponds to a 44% decrease.[44] The business-stealing effect is much smaller in high-heterogeneity counties. First, in these counties, there is a small market expansion following the entry: the total county circulation per eligible voter increases by 1.6 percentage points (Figure 1.3b). Second, the incumbent newspapers' circulation only decreases by between 1.9 percentage points at the time of the entry and 3.5 percentage points ten years after the entry (Figure 1.3d).

Newspaper exit Does an exit symmetrically increase the circulation of remaining newspapers? I estimate equation (1.3) considering only episodes of exit. Figure 1.4 shows the coefficients α^k from this estimation for the period 1960-2012 controlling for demographics, for both low-heterogeneity (1.4a and 1.4c) and high-heterogeneity counties (1.4b and 1.4d). Contrary to what we observe for entries, the magnitude of the effects for exits are very small (to make it appears clearly, I use the same scale for the y-axis of the figures for entry and exit). This difference in magnitude may come from the fact that, as I underline above, while newspapers enter large, they exit small (the circulation of exiting newspapers follows a decreasing trend before exit). We observe an increasing trend in the circulation of incumbent newspapers before exit in both low- and high-heterogeneity counties (Figures 1.4c and 1.4d). Incumbent newspapers recover the circulation of the exiting newspaper even before the actual exit of the newspaper. The existence of a pretrend in the circulation of incumbent newspapers before an exit makes the event-study approach – which relies on the timing of the events of entry and exit – less relevant for the analysis of the effect of

[44]Between 1960 and 2012, the average circulation of incumbent newspapers per eligible voter the year before an entry is 22.55%.



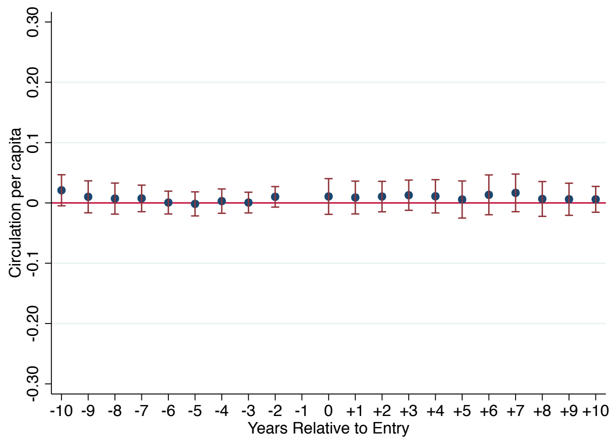
(a) ***Total Circulation***



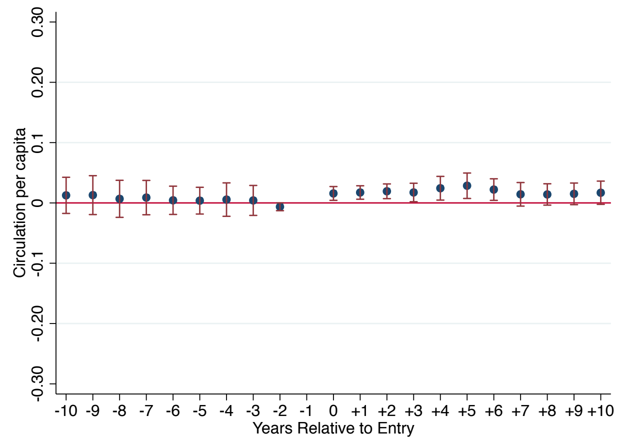
(b) ***Circulation of Incumbent Newspapers***

Notes: The figures show coefficients from a regression of circulation on a vector of year dummies going from -10 to $+10$ with the events of entry taking place in $j = 0$ (see equation (1.3) for details). In the upper figure (1.2a), the dependent variable is total county circulation per eligible voter. In the bottom figure (1.2b), the dependent variable is the circulation of incumbent newspapers per eligible voter. Models include year and county fixed effects. Error bars are $+/-$ 2 standard errors. Standard errors are clustered by events. Time period is 1945-2012.

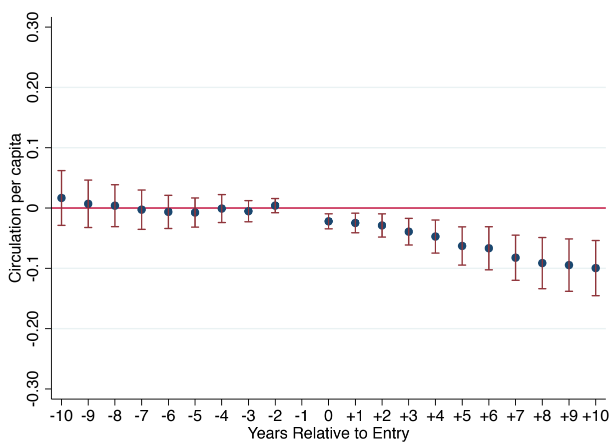
Figure 1.2: *Impact of Newspaper Entry on Newspapers' Circulation (1945-2012) (raw impact without demographic controls)*



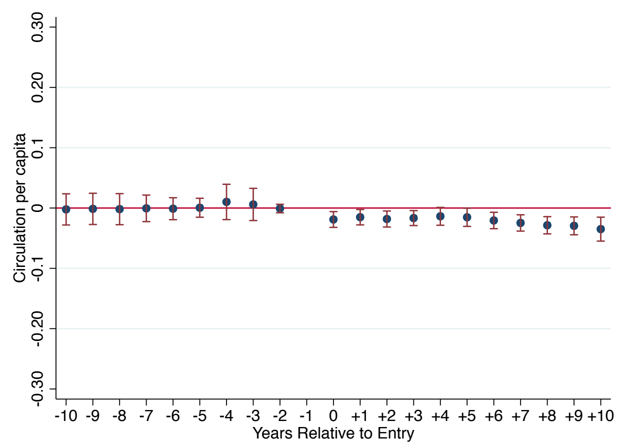
(a) *Total Circulation*
Low-Heterogeneity Counties



(b) *Total Circulation*
High-Heterogeneity Counties



(c) *Incumbents' Circulation*
Low-Heterogeneity Counties



(d) *Incumbents' Circulation*
High-Heterogeneity Counties

Notes: The figures show coefficients from a regression of circulation on a vector of year dummies going from -10 to $+10$ with the events of entry taking place in $j = 0$ (see equation (1.3) for details). In the two upper figures (1.3a and 1.3b), the dependent variable is the total county circulation per eligible voter. In the two bottom figure (1.3c and 1.3d), the dependent variable is the circulation of incumbent newspapers per eligible voter. Figures 1.3a and 1.3c show the effect of an entry on circulation in low-heterogeneity counties. Figures 1.3b and 1.3d show this effect in high-heterogeneity counties. Models include year and county fixed effects and demographic controls. Error bars are $+/-$ 2 standard errors. Standard errors are clustered by events. Time period is 1960-2012.

Figure 1.3: *Impact of Newspaper Entry on Newspapers' Circulation (1960-2012), by Heterogeneity (controlling for demographics)*

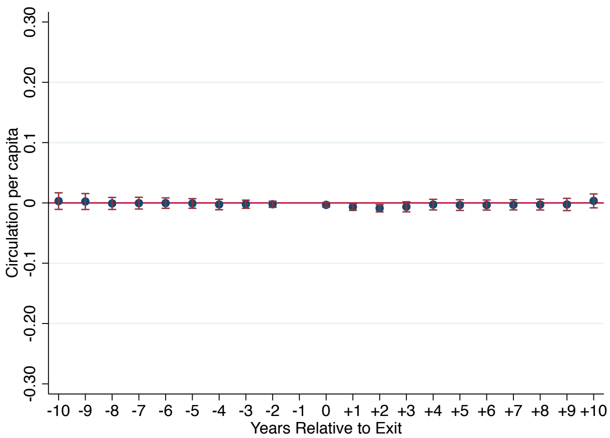
exits (contrary to entries). In the next section I will thus focus on the impact of entry on incumbent newspapers.

1.5.3 The Effect of Newspaper Entry on the Size of the Newsroom

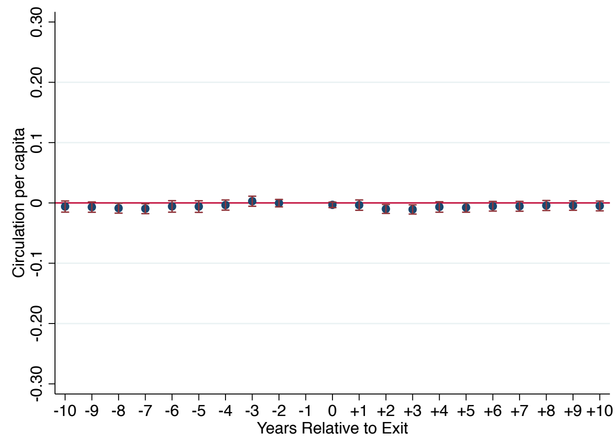
How does the market structure affect the size of the newsroom? To answer this question, I use my panel of newspaper economic indicators that covers the periods 1960 to 2009 (2012 for the number of employees). For each newspaper I observe circulation, operating expenses (on intermediate goods and labor), revenues (from sales and from advertising) and number of employees. I study how the entry of a newspaper on the market affects the value of these outcomes for incumbent newspapers.

Aggregate event studies In Figure 1.5, I plot the coefficients α^k that I obtain by estimating equation (1.3) with a -9 to $+9$ window and different left-hand side variables for incumbent newspapers: alternatively profits (1.5a), total revenues (1.5b), revenues from sales (1.5c); and advertising revenues (1.5d); and in Figure 1.6 for total expenses (1.6a), expenses on intermediate goods (inputs) (1.6b), expenses on labor (payroll) (1.6c), and the number of employees (1.6d). For each of these eight variables, it appears clearly that there is no pretrend. The negative effect of entry happens on impact and grows larger over time (similarly to what happens for circulation). I find that total revenues decrease by $15,830$ (constant 2009) thousand euros[45] six years after an entry. Table A.2 in the Appendix presents descriptive statistics for incumbent newspapers the year preceding an entry. The total revenues of incumbent newspapers are on average equal to €77,762 thousand. The entry of a newspaper thus leads to a 20% decrease of the total revenues of incumbent newspapers. This decrease was expected given the decrease in incumbent newspapers' circulation. It mainly comes from a decrease in revenues from sales which decrease by 27% (€11,605 thousand). Advertising revenues also decrease but only by 15% (€4,897 thousand). This decrease in revenues goes along with a decrease in incumbent newspapers' total expenses. Total expenses decrease

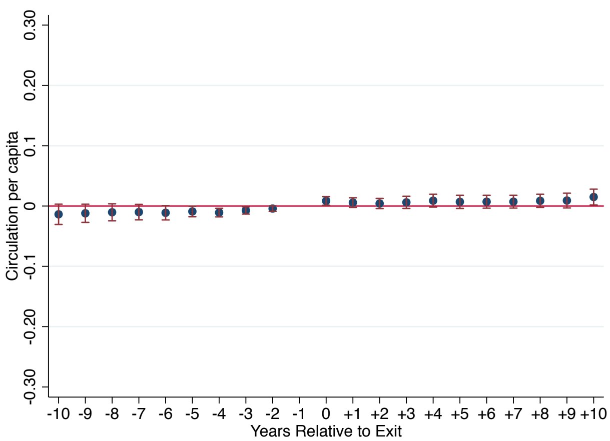
[45] In the remainder of the paper, to save on space, I simply use the terminology "euros" when refering to "constant 2009 euros".



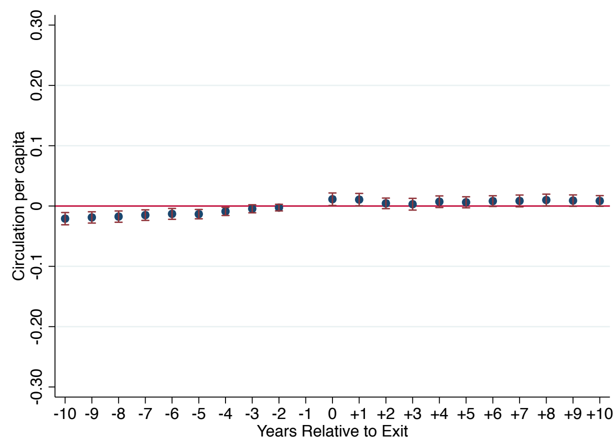
(a) *Total Circulation*
Low-Heterogeneity Counties



(b) *Total Circulation*
High-Heterogeneity Counties



(c) *Incumbents' Circulation*
Low-Heterogeneity Counties



(d) *Incumbents' Circulation*
High-Heterogeneity Counties

Notes: The figures show coefficients from a regression of circulation on a vector of year dummies going from -10 to $+10$ with the events of exit taking place in $j = 0$ (see equation (1.3) for details). In the two upper figures (1.4a and 1.4b), the dependent variable is the total county circulation per eligible voter. In the two bottom figure (1.4c and 1.4d), the dependent variable is the circulation of incumbent newspapers per eligible voter. Figures 1.4a and 1.4c show the effect of an entry on circulation in low-heterogeneity counties. Figures 1.4b and 1.4d show this effect in high-heterogeneity counties. Models include year and county fixed effects and demographic controls. Error bars are $+/-$ 2 standard errors. Standard errors are clustered by events. Time period is 1960-2012.

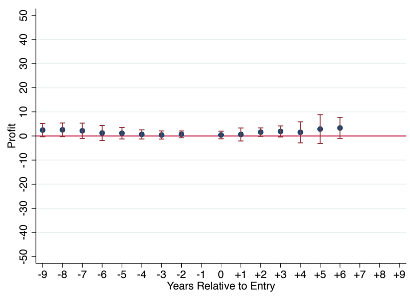
Figure 1.4: *Impact of Newspaper Exit on Newspapers' Circulation (1960-2012), by Heterogeneity (controlling for demographics)*

by 24% six years after the entry (€18,916 thousand). Especially striking is the decrease in labor expenses (payroll) which are reduced by 31%. In comparaison, intermediate goods expenses decrease by 25% and this decrease is only statistically significant at the 10% level. Finally, the number of employees working for incumbent newspapers decrease by 83 after six years, a 16% decrease.

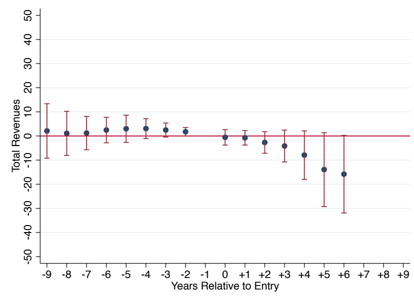
According to my model, the negative effect of an entry on incumbent newspapers' revenues, expenses and number of employees should be especially strong in low-heterogeneity counties. Focusing on the total number of employees which is my first proxy for newspapers' quality, I show that it is indeed the case. In Figure 1.7 I plot the coefficients α^k that I obtain by estimating equation (1.3) with the number of employees as the dependent variable separately for low- (1.7a) and high-heterogeneity counties (1.7b). Entry has a negative effect on the number of employees of incumbent newspapers only in low-heterogeneity areas. The entry of a newspaper reduces the number of employees by 122 after seven years, a 24% decrease.

Fixed effects model I next show that these results are robust to estimating a fixed effects model. The advantage of the fixed effects model are threefold. First, as I underline above, low- and high-heterogeneity counties differ in terms of demographic covariates. The fixed effects model allows me to control, on top of these covariates, for the interaction between these covariates and the heterogeneity indicator. Second, with the fixed effects model, I can control for the events of exit. Finally, this additional model can be seen as a robustness check of my results.

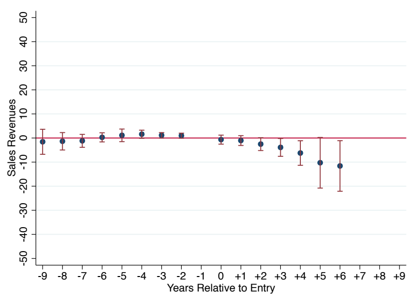
Given the finding that the effect of an entry on expenses, revenues and the number of employees grows larger over time, I allow for time-varying effects of entry on outcomes (Laporte and Windmeijer, 2005). More precisely, to quantify the dynamics effects of the event and control for lags and leads, I define indicator variables for different years around the event and an indicator variable isolating the long-run effect of the shock. My estimating equation is:



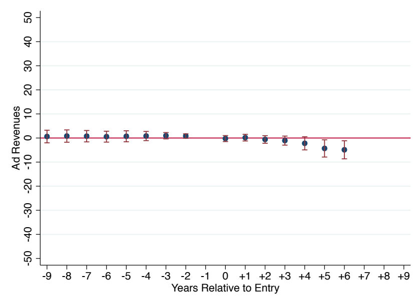
(a) *Profits*



(b) *Total Revenues*



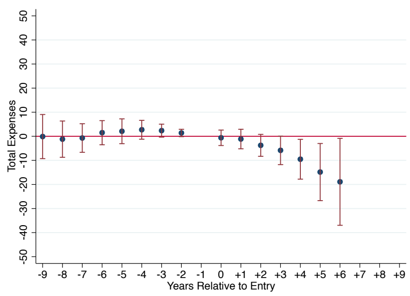
(c) *Revenues from Sales*



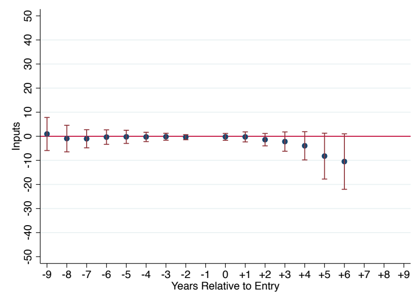
(d) *Advertising Revenues*

Notes: The figures show coefficients from a regression of alternatively profits (Figure 1.5a), total revenues (Figure 1.5b), revenues from sales (Figure 1.5c), and advertising revenues (Figure 1.5d) on a vector of year dummies going from -9 to $+9$ with the events of entry taking place in $j = 0$ (see equation (1.3) for details). All variables are in million (constant 2009) euros. Models include year and county fixed effects and demographic controls. Error bars are $+/-$ 2 standard errors. Standards errors are clustered by events. Time period is 1960-2012.

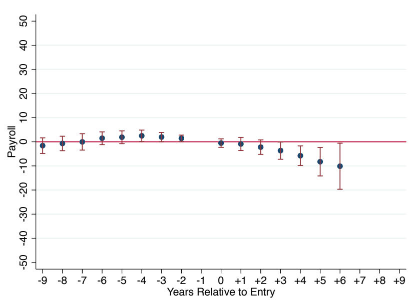
Figure 1.5: *Impact of an Entry on Incumbent Newspapers' Revenues*



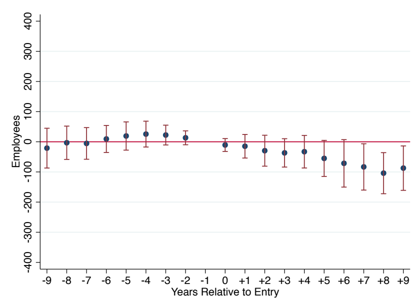
(a) *Total Expenses*



(b) *Intermediate Goods Expenses*



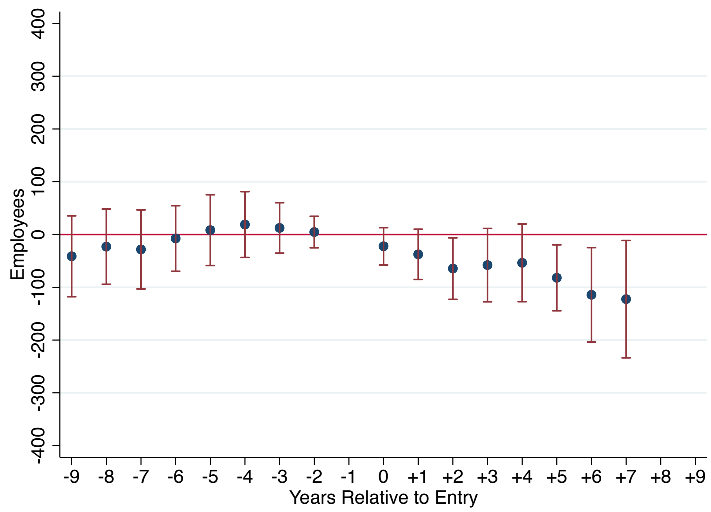
(c) *Labor Expenses (Payroll)*



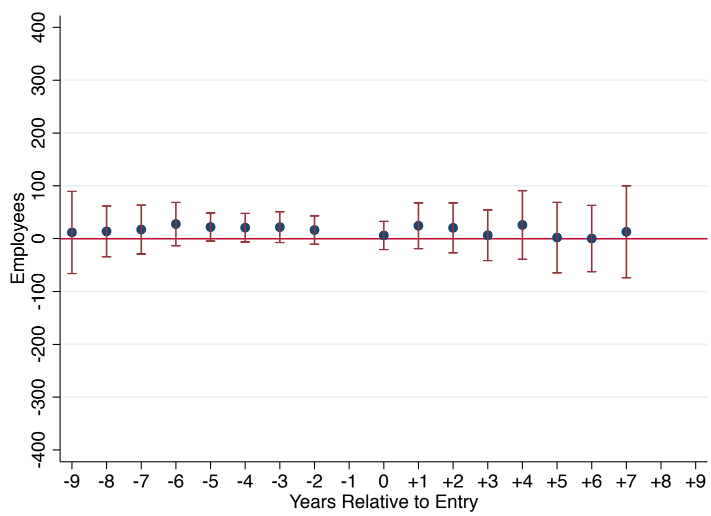
(d) *Number of Employees*

Notes: The figures show coefficients from a regression of alternatively total expenses (Figure 1.6a), intermediate goods expenses (Figure 1.6b), labor expenses (Figure 1.6c) and number of employees (Figure 1.6d) on a vector of year dummies going from -9 to $+9$ with the events of entry taking place in $j = 0$ (see equation (1.3) for details). All variables (excepted employees) are in million (constant 2009) euros. Models include year and county fixed effects and demographic controls. Error bars are $+/-$ 2 standard errors. Standards errors are clustered by events. Time period is 1960-2012.

Figure 1.6: *Impact of an Entry on Incumbent Newspapers' Expenses and Employees*



(a) ***Low-Heterogeneity Counties***



(b) ***High-Heterogeneity Counties***

Notes: The figures show coefficients from a regression of the number of employees on a vector of year dummies going from -9 to $+9$ with the events of entry taking place in $j = 0$ (see equation (1.3) for details). Figure 1.7a shows the effect for low-heterogeneity counties and Figure 1.7b for high-heterogeneity counties. Models include year and county fixed effects and demographic controls. Error bars are $+/-$ 2 standard errors. Standards errors are clustered by events. Time period is 1960-2012.

Figure 1.7: *Impact of an Entry on Incumbent Newspapers' Number of Employees, by Heterogeneity*

$$y_{cnt} = \sum_{k=-2}^{+5} \beta_k \, \mathbf{1}entry_{ct}^{j=k} + \sum_{k=-2}^{+5} \gamma_k \, \mathbf{1}exit_{ct}^{j=k} + \alpha_c + \eta_t + \rho_n + \mathbf{X}_{\mathbf{ct}}^{'}\delta + \varepsilon_{cnt} \qquad (1.4)$$

where c indexes counties, n indexes newspapers and t indexes years. $\mathbf{1}entry_{ct}^{-2} = 1$ in the 2nd year before an entry; $\mathbf{1}entry_{ct}^{-1} = 1$ in the 1st year before an entry; $\mathbf{1}entry_{ct}^{0} = 1$ the year of an entry; $\mathbf{1}entry_{ct}^{1} = 1$ in the 1st year after an entry;...; and $\mathbf{1}entry_{ct}^{5} = 1$ in the 5th year after an entry and all subsequent years. The base period is the years before the entry, excluding the 2nd and 1st years before entry (i.e. from t-3 backwards). I control for a set of indicator variables for exit $\mathbf{1}exit_{ct}^{j=k}$ that are defined the same way.[46] The set of controls $\mathbf{X}_{\mathbf{ct}}^{'}$ includes as before the share of the population with higher (post-secondary) education, the share of working population between 15 and 64 year old which is senior executive or knowledge worker and the total population. The dependent variable y_{cnt} is alternatively newspapers' profits, expenses, revenues and number of employees.

Table 1.4 presents the results for incumbent newspapers. For all the dependent variables, I find no statistically significant effect for the pre-entry indicator variables $\mathbf{1}entry^{-2}$ and $\mathbf{1}entry^{-1}$. Moreover, as expected given the results I obtain with the aggregate event studies specification, I find a negative and statistically significant impact of entry on the different outcomes of interest. For circulation, the negative effect is statistically significant beginning the year of the entry and then grows larger over time. The long-term effect of entry on circulation (captured by the indicator variable $\mathbf{1}entry_{ct}^{5}$) is minus three percentage points (column 1). This corresponds to a 30% decrease in circulation (the average circulation per eligible voter of a newspaper in a county is 9%).

For the other outcomes of interest, the negative effect of an entry only becomes statistically significant after three years. In the long run, total revenues decrease by €6,044, a 36% decrease (column 3). The number of employees in the long run decreases by more than 70, a 57% decrease. Moreover, while entry has a strong negative effect on each individual newspaper' revenues, expenses and number of employees, I show in the Appendix Table

[46] To save on space, I only report the coefficients for entry variables since there are the only coefficients of interest. Results are robust to controlling or not for the exit indicator variables.

A.6 – in which the dependent variables are values aggregated at the county level – that it has no positive effect at the aggregate market level. There are no statistically significant changes in total county's revenues and expenses at the time of an entry nor in the following years. In particular, there is no increase in aggregate payroll or number of employees. Given the fixed costs of news production, through the duplication of these costs, the entry of a newspaper may lead to a decrease in the total amount of news produced at the county level.

Heterogeneity Finally, I study how the impact of an entry on circulation, revenues, expenses and the number of employees varies with heterogeneity. For the sake of simplicity and readability, I regroup my indicator variables for the years before and after entries into three indicator variables: pre-entry ($\mathbf{1}entry_{ct}^{\text{pre-entry}} = 1$ in the 2nd and 1st pre-entry year), short-run entry ($\mathbf{1}entry_{ct}^{\text{short-run}} = 1$ in the entry year, the 1st and the 2nd post-entry year) and long-run entry ($\mathbf{1}entry_{ct}^{\text{long-run}} = 1$ in the 3rd post-entry year and all subsequent years). The base period is the years before the entry, excluding the pre-entry period (i.e. from $t-3$ backwards). I interact these indicator variables with the heterogeneity indicator variable.[47] More precisely, my empirical specification is (abstracting from the exit terms):

$$\begin{aligned} y_{cnt} = {} & \beta_{\text{pre-entry}}\ \mathbf{1}entry_{ct}^{\text{pre-entry}} + \theta_{\text{pre-entry}}\ \mathbf{1}entry_{ct}^{\text{pre-entry}} * \text{Low Heterogeneity}_c \\ & + \beta_{\text{short-run}}\ \mathbf{1}entry_{ct}^{\text{short-run}} + \theta_{\text{short-run}}\ \mathbf{1}entry_{ct}^{\text{short-run}} * \text{LowHeterogeneity}_c \\ & + \beta_{\text{long-run}}\ \mathbf{1}entry_{ct}^{\text{long-run}} + \theta_{\text{long-run}}\ \mathbf{1}entry_{ct}^{\text{long-run}} * \text{Low Heterogeneity}_c \\ & + \mathbf{X}_{\mathbf{ct}}^{'}\delta + \mathbf{X}_{\mathbf{ct}}^{'} * \text{Low Heterogeneity}_c\sigma \\ & + \alpha_c + \eta_t + \rho_n + \varepsilon_{cnt} \end{aligned} \tag{1.5}$$

where Low Heterogeneity$_c$ is the low-heterogeneity indicator variable equal to one for low-heterogeneity counties and to zero otherwise. I allow the demographic covariates $\mathbf{X}_{\mathbf{ct}}^{'}$ to have a different impact in low- and high-heterogeneity counties.

In Table 1.5, I estimate equation (1.5) with different dependent variables at the newspaper

[47] In the Appendix Table A.7, I find estimates consistent with the ones in Table 1.4 using these indicator variables rather than the yearly indicator variables.

Table 1.4: *The Effect of Entry on Newspapers' Revenues, Expenses and Number of Employees (newspaper-level analysis)*

			Revenues			Expenses			
	(1) Circulation	(2) Profit	(3) Total	(4) Sales	(5) Ad	(6) Total	(7) Inputs	(8) Payroll	(9) Employees
$\mathbf{1}entry^{j=-2}$	-0.00	-232.87	-100.95	-96.03	484.41	1,118.97	456.92	785.22	3.23
	(0.01)	(517.12)	(2,331.83)	(1,095.82)	(688.97)	(2,245.91)	(1,020.65)	(1,229.92)	(18.66)
$\mathbf{1}entry^{j=-1}$	-0.01	-718.63	-1,116.49	-362.77	213.48	734.58	400.27	720.48	-6.00
	(0.01)	(623.82)	(2,849.69)	(1,503.78)	(994.55)	(2,799.22)	(1,095.93)	(1,742.17)	(23.05)
$\mathbf{1}entry^{j=0}$	-0.01*	-728.60	-2,714.67	-1,638.34	-419.09	-803.42	-538.14	-2.03	-25.53
	(0.01)	(667.26)	(3,066.32)	(1,794.66)	(1,124.49)	(2,887.37)	(1,195.85)	(1,719.92)	(22.11)
$\mathbf{1}entry^{j=1}$	-0.01*	-947.77	-3,737.25	-2,870.66	-564.61	-2,133.41	-1,154.10	-619.64	-33.18
	(0.01)	(843.24)	(3,201.66)	(1,886.89)	(1,163.09)	(2,923.87)	(1,349.45)	(1,701.64)	(22.37)
$\mathbf{1}entry^{j=2}$	-0.01*	-571.18	-3,506.84	-2,978.59	-393.13	-1,995.65	-945.82	-718.40	-33.89
	(0.01)	(822.21)	(3,525.35)	(1,963.50)	(1,318.41)	(3,392.81)	(1,445.40)	(1,966.51)	(28.51)
$\mathbf{1}entry^{j=3}$	-0.01*	-368.95	-5,232.64	-4,067.84**	-1,557.67	-3,691.44	-1,691.92	-1,763.63	-47.41*
	(0.01)	(391.28)	(3,484.77)	(1,869.80)	(1,067.66)	(3,162.30)	(1,777.41)	(1,596.07)	(25.73)
$\mathbf{1}entry^{j=4}$	-0.02**	-715.72	-8,536.74**	-6,004.21**	-3,241.02**	-7,168.77*	-3,727.97	-3,391.63*	-77.22**
	(0.01)	(532.95)	(4,094.62)	(2,404.33)	(1,402.71)	(3,845.37)	(2,280.68)	(1,962.24)	(37.84)
$\mathbf{1}entry^{j\geq5}$	-0.03***	-839.32	-6,042.97**	-6,836.36***	-4,226.67***	-4,699.48*	-2,026.54	-2,202.20	-70.62***
	(0.01)	(671.38)	(3,022.30)	(2,163.20)	(1,084.97)	(2,695.34)	(1,498.46)	(1,675.75)	(23.16)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
News FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.65	0.47	0.81	0.83	0.80	0.82	0.84	0.77	0.77
Observations	5,158	3,388	3,367	2,624	2,614	3,384	3,390	3,388	3,598
Clusters	87	78	78	78	78	78	78	78	87
Mean DepVar	0.09	270.99	16,961.10	10,445.64	7,220.46	16,664.42	8,713.58	7,133.33	124.63

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by county. Time period is 1960-2009. Models are estimated using OLS estimations. All variables (excepted employees and price) are in thousand (constant 2009) euros. Price is in (constant 2009) euros. Models include year and county fixed effects and demographic controls. The demographic controls are the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in county c and year t. Variables are described in more details in the text.

level: circulation, profit, revenues, expenses and the number of employees. For all these variables, it appears clearly that the negative effect of an entry is entirely driven by low-heterogeneity areas. While there is no impact of an entry on the number of employees in high-heterogeneity counties, this number decreases by 89 in low-heterogeneity counties. This is consistent with the first testable prediction of my simple theoretical framework, when I proxy newspaper quality by the number of journalists: under low heterogeneity in the willingness-to-pay for quality, the entry of a newspaper leads to a decrease in the quality of newspapers.

Robustness These results are robust to using education heterogeneity rather than socio-economic group heterogeneity. Individuals above 15 years old are classified into $n = 6$ different education degrees in the census.[48] However, the main advantage of using socio-economic groups rather than education degrees comes from readers' demographic characteristics. In the Appendix Table A.4, using survey data for the year 2006, I show that the distribution of local daily newspapers' readers among socio-economic groups is almost similar to the distribution of the French population among these groups – while interestingly and as one would have expected, there are important differences if one considers the characteristics of *national* daily newspapers' readers. On the contrary, it appears that local daily newspapers' readers are more educated than the average.

The results are also robust to using an alternative measure of heterogeneity derived from Shannon's measure of information entropy: $H_{ct} = \sum_{i=1}^{n} p_{ict} log\left(\frac{1}{p_{ict}}\right)$, where p_{ict} is the share of the population from socio-economic group i in county c and year t. This measure is strongly correlated with the measure constructed using the Herfindahl index.

In the next sub-section, I study how the number of newspapers on a market impacts the

[48](i) No diploma; (ii) "Certificat d'études primaires" which is a diploma awarded at the end of elementary primary education in France (which was officially discontinued in 1989); (iii) "BEPC" or "brevet" which is a diploma given to French pupils at the end of the "3ème" (which corresponds to year 10 or ninth grade); (iv) "Certificat d'aptitude professionnelle" (CAP) or "brevet d'études professionnelles" (BEP) which are secondary and vocational education diplomas; (v) "Baccalauréat" which is an academic qualification taken at the end of the lycée (secondary education) and the main diploma required to pursue university studies; (vi) Higher (post-secondary) education. In the Appendix Figure A.19 I show the evolution of the educational attainment in France between 1960 and 2012.

Table 1.5: *The Effect of Entry on Incumbent Newspapers' Revenues and Expenses and Number of Employees, by Heterogeneity (newspaper-level analysis)*

			Revenues			Expenses			
	(1) Circulation	(2) Profit	(3) Total	(4) Sales	(5) Ad	(6) Total	(7) Inputs	(8) Payroll	(9) Employees
Pre Entry (t-2, t-1)	-0.00	29.24	3,520.56	1,879.16	1,253.37	3,936.25	2,018.32	2,037.68	4.84
	(0.01)	(603.90)	(4,252.05)	(2,175.55)	(1,775.96)	(3,878.75)	(1,449.09)	(2,452.94)	(29.56)
Pre Entry * Low Heterogeneity (t-2, t-1)	-0.00	-1,114.67	-7,914.18	-3,646.19	-1,348.14	-5,699.86	-3,232.54	-2,251.50	-9.33
	(0.01)	(1,008.48)	(5,443.72)	(2,897.04)	(2,156.81)	(5,257.89)	(2,184.60)	(3,084.50)	(42.87)
Short-run Impact of Entry (t, t+1, t+2)	0.00	-144.71	3,000.23	1,529.57	1,658.10	3,750.59	1,606.85	2,202.81	1.65
	(0.01)	(683.90)	(4,661.22)	(2,760.51)	(2,183.98)	(4,748.04)	(1,594.79)	(3,139.39)	(36.33)
Short-run * Low Heterogeneity Impact of Entry (t, t+1, t+2)	-0.02*	-1,159.44	-11,615.18**	-7,173.65**	-3,800.88	-9,920.14*	-4,808.06**	-4,730.24	-58.45
	(0.01)	(1,108.26)	(5,779.21)	(3,433.84)	(2,418.46)	(5,529.89)	(2,203.80)	(3,473.21)	(44.35)
Long-run Impact of Entry (t+3, onwards)	0.01	49.03	-643.96	-24.77	633.88	-41.28	-126.72	190.55	-6.54
	(0.01)	(346.47)	(2,846.28)	(2,103.11)	(1,649.07)	(3,037.41)	(1,567.90)	(1,952.07)	(30.16)
Long-run * Low Heterogeneity Impact of Entry (t+3, onwards)	-0.04***	-1,215.94*	-9,965.04**	-7,127.45**	-4,270.39*	-8,740.20*	-4,051.23	-4,402.63*	-82.83**
	(0.01)	(684.69)	(4,873.48)	(3,479.97)	(2,193.40)	(4,390.62)	(2,509.17)	(2,599.26)	(39.73)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
News FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.65	0.48	0.81	0.84	0.80	0.82	0.84	0.77	0.77
Observations	4,701	3,388	3,367	2,624	2,614	3,384	3,390	3,388	3,598
Clusters	87	78	78	78	78	78	78	78	87
Mean DepVar	0.09	270.99	16,961.10	10,445.64	7,220.46	16,664.42	8,713.58	7,133.33	124.63

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. Standard errors in parentheses are clustered by county. Time period is 1960-2009. Models are estimated using OLS estimations. All variables (excepted employees) are in thousand (constant 2009) euros. Models include year and county fixed effects, demographic controls and demographic controls interacted with the heterogeneity indicator variable. The demographic controls are the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in county c and year t. Variables are described in more details in the text.

size of the newspapers, which is my second proxy for newspaper quality.

1.5.4 The Effect of Newspaper Entry on the Size of Newspapers

1.5.4.1 Cross-Sectional Analysis

How does the structure of the news market affect the quantity of news produced by newspapers? I cannot estimate as before the impact of the entry of a newspaper given the fact that I only have data on newspapers' content for recent years (2005-2012). I thus simply estimate the impact of the number of newspapers on the size of newspapers using a cross-sectional approach. A potential issue is that there may be selection in the cross-section. Reassuringly, the results of the previous section are robust to such an approach. Let c index counties, d index the date (in days), t index year and n index newspapers. I assume that:

$$\begin{aligned} size_{ntd} =& \alpha_1 + \alpha_2 N_{nct} + \alpha_3 N_{nct} * \text{Low Heterogeneity}_c + \alpha_4 \text{Low Heterogeneity}_c \\ & + \mathbf{X'_{ct}} \alpha_5 + \mathbf{X'_{ct}} * \text{Low Heterogeneity}_c \alpha_6 + \mu_t + \varepsilon_{nctd} \end{aligned} \tag{1.6}$$

where N_{nct} is the number of newspapers in year t in the county c in which the newspaper n is headquartered, $\mathbf{X'_{ct}}$ is a vector of observable characteristics, μ_t is a year fixed effect and ε_{nctd} is a newspaper-county-day-year shock. Low Heterogeneity$_c$ is the low-heterogeneity indicator variable equal to one for low-heterogeneity counties and to zero otherwise.

$size_{ntd}$, my key dependent variable of interest, is the size of the newspaper. I compute three different indicators of the size: (i) the number of articles by newspaper; (ii) the total number of words by newspaper; (iii) the total number of words on the newspaper frontpage. To adjust standard errors for possible dependence in residuals, I cluster my standard errors at the county-year level.

Table 1.6 shows the impact of the number of newspapers on the news market on the size of newspapers and how it varies with the extent of heterogeneity. In the upper panel I consider the total number of articles in the newspaper (1.6a), and in the bottom panel the total number of words (1.6b). The results I obtain are robust to using these two measures.

First, I find that the number of articles in a newspaper statistically significantly decreases with the number of newspapers on the market: one additional newspaper decreases the number of articles by 136, a 32% decrease (column 1). The total number of words decreases by 43% and the number of words on the frontpage by 15%. Second, this effect is driven by low-heterogeneity counties. While I find no statistically significant impact of the number of newspapers on the size of newspapers in high-heterogeneity counties, I find that one additional newspaper of the market decreases the number of articles in the newspaper by more than 280 in low-heterogeneity counties (column 2). This result is robust to controlling for year fixed effects (column 3) as well as for the demographic covariates and their interaction with the heterogeneity indicator (column 4). Moreover, I find similar results when considering the total number of words in the newspaper. This negative correlation between the number of newspapers on the market and the size of newspapers in low-heterogeneity counties is consistent with the first prediction of my simple theoretical framework when I proxy the quality of newspapers with their size. In the next section, I investigate how the content of newspapers varies with the market structure.

1.5.5 Extension: Newspaper Competition and the Type of News Produced

In the extension of the theoretical framework, I divide newspaper content between hard and soft news. Classifying newspaper content between hard and soft news is an empirical challenge *per se*, especially because there are “news hybrids" and because what is informative in the political process for a citizen may not be for another one. I consider as hard news articles which are informative for the reader at the time of the elections, even if they sometimes incorporate entertainment elements. On the contrary, soft news is non-informative in the political process.[49]

In order to study the distribution of articles by topic, I use the information provided by

[49] According to Patterson (2000), soft news are *“typically more sensational, more personality-centered, less time-bound, more practical, and more incident-based than other news”* (p.4). Another possible terminology is the one used by Boczkowski (2010) who distinguishes “public affairs" news (national, business, economic and international topics) and “non-public affairs" news (sports, entertainment and crime subjects).

Table 1.6: *The Effect of the Number of Newspapers on the Size of Newspapers*

(a) ***Number of Articles***

	Number of Articles in the Newspaper			
	(1)	(2)	(3)	(4)
Number of newspapers	-136.45***	-61.79	-61.05	-70.17
	(28.39)	(74.63)	(68.71)	(64.00)
Number of newspapers				
* Low Heterogeneity		-225.04***	-221.61***	-155.84**
		(84.19)	(79.88)	(67.82)
Low Heterogeneity		567.13***	549.68***	-233.82
		(144.29)	(145.09)	(228.63)
Year FE	No	No	Yes	Yes
Controls	No	No	No	Yes
R-sq	0.11	0.23	0.25	0.65
Observations	27,708	27,708	27,708	27,708
Clusters (County-Year)	106	106	106	106
Mean DepVar	421.17	421.17	421.17	421.17

(b) ***Number of Words***

	Number of Words in the Newspaper			
	(1)	(2)	(3)	(4)
Number of newspapers	-46,282***	-17,858	-16,536	-15,553
	(7,065)	(21,239)	(19,315)	(19,898)
Number of newspapers				
* Low Heterogeneity		-66,443***	-65,104***	-52,957**
		(23,102)	(21,354)	(21,242)
Low Heterogeneity		158,223***	152,088***	-41,013
		(37,834)	(37,126)	(59,848)
Year FE	No	No	Yes	Yes
Controls	No	No	No	Yes
R-sq	0.18	0.29	0.32	0.65
Observations	30,502	30,502	30,502	30,502
Clusters (County-Year)	106	106	106	106
Mean DepVar	107,044	107,044	107,044	107,044

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. Standard errors in parentheses are clustered by county-year. Time period is 2005-2012. Models are estimated using OLS. In the upper table (Table 1.6a) the dependent variable is the number of articles per newspaper. In the bottom table (Table 1.6b), the dependent variable is the number of words per newspaper. The demographic controls are the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker, the total population in county c and year t and demographic controls interacted with the heterogeneity indicator variable. Variables are described in more details in the text.

the website Lexis-Nexis. When I retrieve the entire content of newspapers, I also retrieve all the metadata (tag) associated with each newspaper article, and in particular its title, topic and subject. Combining information from the title, topic and subject, I determine for each article its category. I create 13 different categories: agriculture, culture, economics, education, environnement, health, international, leisure activities, movies, "news in brief" (*faits divers*), politics, religion and sports. I define the share of hard news articles as the number of articles on agriculture, economics, education, environnement, international or politics, divided by the total number of articles classified by topics. Symmetrically, I define the share of soft news articles as the number of articles on culture, health, leisure activities, movies, "news in brief", religion or sports, divided by the total number of articles classified by topics.

I then estimate equation (1.6) with the share of hard news articles, the number of hard news articles and the number of soft news articles as my dependent variables of interest. An important empirical issue here is the choice of the heterogeneity measure. While until now – following the theoretical framework for proposition 1 – I proxy heterogeneity in the willingness-to-pay for quality using socio-economic group heterogeneity, the prediction of my extended theoretical framework does not depend on heterogeneity in the willingness-to-pay for quality, but on the relative heterogeneity in the willingness-to-pay for hard news and for soft news: holding heterogeneity in the willingness-to-pay for soft news constant, newspaper entry leads to a decrease in the quantity and share of hard news produced by newspapers if heterogeneity in the willingness-to-pay for hard news is low.[50]

I thus use the measure of heterogeneity in the willingness-to-pay for hard news described above, namely political polarization. Table 1.7 presents the results. The upper table presents the results for the share of articles on hard news (1.7a), and the bottom table for the number of articles on hard news (1.7b). As predicted by the model, I find that the share of articles

[50] When I estimate equation (1.6) with the share of articles on hard news as the dependent variable, I find that this share decreases when the number of newspapers increases, but that there are no statistically significant differences between low- and high-heterogeneity counties. I present these results in the Appendix Tables A.8 and A.9. Only the number of articles on soft news decreases statistically significantly more in low- than in high-heterogeneity counties.

on hard news decreases with the number of newspapers on the market. An increase by one in the number of newspapers decreases the share of articles on hard news by around 3.5 percentage points, a 10, 5% decrease (column 1). This effect is robust to introducing year fixed effects (column 3) and to controlling for demographics (column 5). Moreover, this effect is stronger in low- than in high-heterogeneity counties. In low-heterogeneity counties, one additional newspaper decreases the share of hard news by more than 18%.

The decline in the share of articles on hard news can come either from a decrease in the number of articles on hard news or an increase in the number of articles on soft news (possibly with no change in the number of articles on hard news). In the bottom table 1.7b, I estimate the impact of the number of newspapers on the number of articles on hard news in the newspaper. I find that this impact is negative and statistically significant. An increase by one in the number of newspapers decreases the amount of articles on hard news by between 33 and 49 depending on the specifications, a 37 to 54% decrease. Moreover, I find that this effect is higher in low- than in high-heterogeneity counties, as predicted by the theoretical framework. Finally, in the bottom table 1.8, I investigate how the number of articles on soft news varies with the number of newspapers. I find that it decreases with the number of newspapers but that there are no statistically significant differences between low- and high-heterogeneity counties once I control for year fixed effects and demographics.

Newspaper specialization These results are consistent with the predictions of the extension of my simple theoretical framework when there is more heterogeneity in the tastes for soft news than for hard news. Another testable implication of the model is that an increase in competition leads to an increase in newspaper specialization. In the Appendix Table A.10, I present the results of the estimation of equation (1.6) with newspaper specialization – measured with the Herfindahl index described in Section 4.3 – as the dependent variable. I find as expected that more competition leads to more newspaper differentiation: a one-standard deviation increase in the number of newspapers leads to a 0.19 standard deviations increase in the Herfindahl index of newspaper specialization. Moreover, this effect is lower in low-heterogeneity counties (the α_3 coefficient is negative and statistically significant).

Table 1.7: *The Effect of the Number of Newspapers on Newspapers' Content (Hard News)*

(a) ***Share of Articles on Hard News***

	Share of Articles on Hard News in the Newspaper					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of newspapers	-3.55***	-1.38**	-3.68***	-2.32***	-3.44***	-2.12**
	(0.73)	(0.66)	(0.77)	(0.78)	(0.79)	(0.83)
Number of Newspapers						
* Low Political Heterogeneity		-4.87***		-3.25*		-3.96**
		(1.82)		(1.64)		(1.97)
Low Political Heterogeneity		10.02***		6.40**		7.18*
		(3.52)		(3.11)		(3.68)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.06	0.08	0.12	0.13	0.12	0.13
Observations	25,745	25,745	25,745	25,745	25,745	25,745
Clusters (County-Year)	88	88	88	88	88	88
Mean DepVar	33.73	33.73	33.73	33.73	33.73	33.73

(b) ***Number of Articles on Hard News***

	Number of Articles on Hard News in the Newspaper					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of newspapers	-48.6***	-14.6*	-49.4***	-24.0***	-33.3***	-17.8***
	(8.6)	(8.6)	(8.2)	(8.1)	(7.8)	(5.3)
Number of Newspapers						
* Low Political Heterogeneity		-49.7***		-36.1***		-42.3**
		(14.4)		(13.2)		(19.5)
Low Political Heterogeneity		132.8***		99.2***		76.5**
		(32.9)		(30.3)		(36.3)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.17	0.26	0.27	0.32	0.35	0.36
Observations	27,170	27,170	27,170	27,170	27,170	27,170
Clusters (County-Year)	94	94	94	94	94	94
Mean DepVar	90.8	90.8	90.8	90.8	90.8	90.8

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by county-year. Time period is 2005-2012. In the upper table (Table 1.7a), the dependent variable is the share of articles on hard news which is defined as the number of articles on agriculture, economics, education, environnement, international or politics, divided by the total number of articles classified by topics. In the bottom table (Table 1.7b), the dependent variable is the number of articles on hard news. The controls include demographic controls (the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in county c and year t) and the demographic controls interacted with the heterogeneity indicator variable. Variables are described in more details in the text.

Table 1.8: *The Effect of the Number of Newspapers on Newspapers' Content (Soft News)*

	Number of Articles on Soft News in the Newspaper					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of newspapers	-73.0***	-28.5*	-74.6***	-37.9**	-42.3***	-27.5***
	(13.6)	(16.9)	(13.6)	(16.4)	(12.0)	(10.0)
Number of Newspapers						
* Low Political Heterogeneity		-64.2**		-51.5*		-47.3
		(26.2)		(26.0)		(34.6)
Low Political Heterogeneity		174.4***		144.2**		70.6
		(56.2)		(56.9)		(62.2)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.16	0.23	0.21	0.25	0.33	0.34
Observations	27,291	27,291	27,291	27,291	27,291	27,291
Clusters (County-Year)	94	94	94	94	94	94
Mean DepVar	166.0	166.0	166.0	166.0	166.0	166.0

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. Standard errors in parentheses are clustered by county-year. Time period is 2005-2012. The dependent variable is the number of articles on hard news. The controls include demographic controls (the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in county c and year t) and the demographic controls interacted with the heterogeneity indicator variable. Variables are described in more details in the text.

This finding is in line with the intuition of the theoretical framework: when heterogeneity is low, there is less space for differentiation and newspaper specialization is thus lower. In the next section, I look into the impact of a change in the number of newspapers on political participation.

1.6 Media Competition and Electoral Turnout

According to the third prediction of my simple theoretical framework, under low willingness-to-pay for quality heterogeneity, the entry of a newspaper leads to a decrease in turnout at elections.

1.6.1 Specification and Identification Strategy

To test this prediction, I match my panel data on newspaper competition with mayoral election results from 1947 to 2008 and track the impact of a change in competition on turnout. Let w index cities, c index counties and $t \in \{1, ..., 11\}$ index election years (one time unit representing six calendar years). The outcome of interest, y_{wct}, is voter turnout in city w in county c at time t. The key independent variable of interest is N_{wct}, the number of newspapers in city w in county c at time t. Since turnout varies at the city level while the number of newspapers varies at the county level (if two cities are in the same county, they have the same number of newspapers), I cluster the standard errors at the county level.

I assume that

$$\begin{aligned} turnout_{wct} = {} & \alpha_1 N_{wct} + \alpha_2 N_{wct} * \text{Low Heterogeneity}_c + \alpha_3 \text{Low Heterogeneity}_c \\ & + \mathbf{X'_{wt}}\delta_1 + \mathbf{X'_{wt}} * \text{Low Heterogeneity}_c \delta_2 + \rho_w + \mu_{rt} + \varepsilon_{wct} \end{aligned}$$

where ρ_w is a city fixed effect, μ_{rt} is an election-region fixed effect, $\mathbf{X'_{wt}}$ is a vector of observable characteristics at the city level, δ_1 and δ_2 are vectors of parameters and ε_{wct} is a city-county-year shock. Low Heterogeneity_c is the low-heterogeneity indicator variable equal to one for low-heterogeneity counties and to zero otherwise.

Similarly to what is done in Gentzkow *et al.* (2011), I estimate the model in first differences. My estimation equation is then:

$$\begin{aligned} \Delta turnout_{wct} = {} & \alpha_1 \Delta N_{wct} + \alpha_2 \Delta N_{wct} * \text{Low Heterogeneity}_c \\ & + \Delta\mathbf{X'_{wt}}\delta_1 + \Delta\mathbf{X'_{wt}} * \text{Low Heterogeneity}_c \delta_2 + \Delta\mu_{rt} + \varepsilon_{wct} \end{aligned} \tag{1.7}$$

where Δ is a first-difference operator. The vector of controls $\mathbf{X'_{wt}}$ includes as before the share of the population (15+-year old) with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is laborer and the total population. Controls are defined at the city level.

1.6.2 Main Results

Table 1.9 presents the results. In the upper table (1.9a), I show the effect of an additional newspaper on local turnout. Column 1 presents this effect without considering heterogeneity. I find that one additional newspaper decreases turnout by approximately 0.3 percentage points. In columns 2 and 3, it appears clearly that this negative effect is driven by low-heterogeneity counties. I find no statistically significant impact of a change in the number of newspapers on turnout at elections in high-heterogeneity counties. On the contrary, when I focus on low-heterogeneity counties, I find that the effect of an entrant on the market is minus 0.6 percentage points and is statistically significant at the five-percent level.

The average turnout rate at local elections is 67%. The Appendix Figure A.17 shows how it varies between 1947 and 2008. It oscillates between 70% and 77% during the period 1947-1977 and since then has been declining. In the 2008 election it was equal to 62%. Related to the 15 percentage points decrease in turnout between 1947 and 2008, the 0.6 percentage points negative effect of a typical entry is thus of importance. Note moreover that this negative turnout effect is only due to the introduction of an additional local newspaper. If I extrapolate my results to other medias, this suggests that the large increase in media competition during recent decades can potentially explain a siginificant fraction of the historical decline in turnout.

My identification relies on changes in the number of newspapers over time. As a result it is correct as long as the timing of these changes is random. In the bottom table (1.9b), I undertake a falsification test using the timing of the changes which seems to confirm that it is indeed the case. I estimate the impact of a future change in the news market on current turnout. The coefficients I obtain are all non significant. This suggests that changes in the number of newspapers are not driven by election results and brings confidence in interpreting the coefficients of the upper table (1.9a) as causal effects.

In this paper I estimate the impact of local newspapers on local elections because in the television and internet era, local newspapers remain the most important source of information only about local politics; information on national politics is widely available throug other media outlets. In the Appendix, I show that there is no statistically significant effect of a change in the number of local daily newspapers on turnout at national (Congressional or Presidential) elections.

Table 1.9: *The Effect of a Change in the Number of Newspapers on Voter Turnout*

(a) ***Effect of Newspaper Entry/Exit on Voter Turnout***

	Turnout		
	(1)	(2)	(3)
Number of Newspapers	-0.003*	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
Number of Newspapers * Low Heterogeneity		-0.005**	-0.005**
		(0.002)	(0.003)
Region-Year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Controls*Heterogeneity	No	No	Yes
R-sq	0.37	0.37	0.37
Observations	3,565	3,565	3,565
Clusters (County)	87	87	87
Mean DepVar	-0.024	-0.024	-0.024

(b) ***Falsification Test***

	Turnout at Previous Election		
	(1)	(2)	(3)
Number of Newspapers	-0.000	-0.002	-0.002
	(0.002)	(0.002)	(0.002)
Number of Newspapers * Low Heterogeneity		0.004	0.004
		(0.002)	(0.003)
Region-Year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Controls*Heterogeneity	No	No	Yes
R-sq	0.35	0.35	0.35
Observations	3,058	3,058	3,058
Clusters (County)	87	87	87
Mean DepVar	-0.030	-0.030	-0.030

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by county. Time period is 1947-2008. Models are estimated in first differences. All specifications include election-region fixed effects. The controls include demographic controls (the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in city w and year t) and the demographic controls interacted with the heterogeneity indicator variable. In the upper Table (1.9a), the dependent variable is turnout. In the bottom Table (1.9b), I perform a falsification test: the dependent variable is turnout at the previous election.

1.6.2.1 Diagnosing Bias Using Pre-trends

Finally, as an additional check supporting a causal interpretation of my findings, I use pretrends. If the relationship between ΔN_{wct} and Δy_{wct} comes only from a causal effect, ΔN_{wct} cannot be correlated with past values of Δy_{wct}. On the contrary, if the observed relationship is driven by omitted components, ΔN_{wct} and past values of Δy_{wct} may be correlated.

In Figure 1.8 I plot the coefficient α^k from the following specification:

$$\Delta turnout_{wct} = \sum_{k=-1}^{+1} \alpha^k \Delta N_{wc(t-k)} + \Delta \mathbf{X'_{wt}}\delta + \Delta\mu_{rt} + \Delta\varepsilon_{wct} \tag{1.8}$$

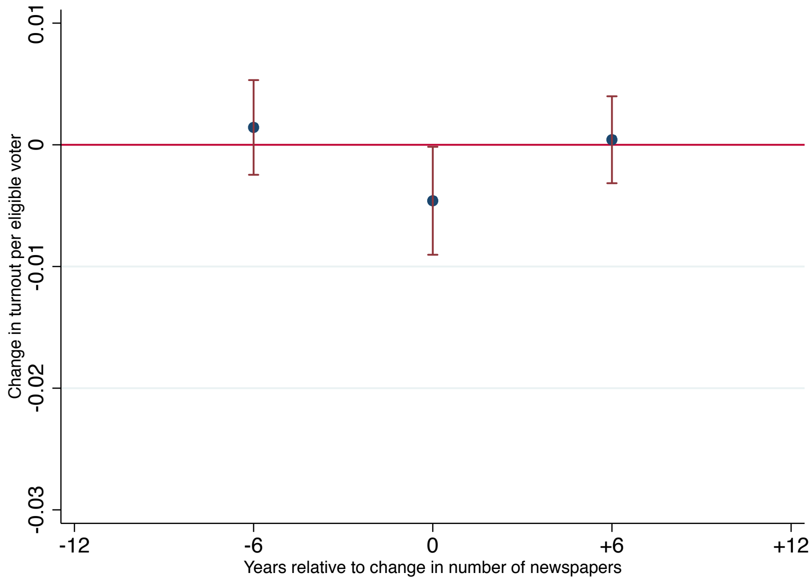
where variables are defined as in equation (1.7). I perform the analysis for the entire sample (upper Figure 1.8a) and for low-heterogeneity counties only (bottom Figure 1.8b). The prediction that newspaper entry decreases turnout corresponds to the negative spike in the plot at $k = 0$. Importantly, there are no significant trends before or after the event.[51] Moreover, the effect is of higher order of magnitude for low-heterogeneity counties, as predicted by the model.

1.6.2.2 Magnitude of the effects

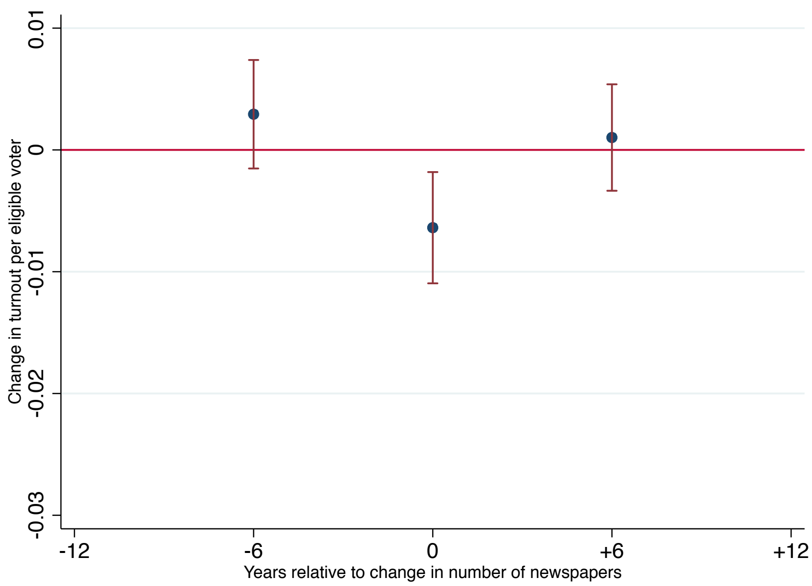
My estimates suggest that increasing newspaper competition by introducing an additional newspaper to a county decreases mayoral turnout per eligible voter by about 0.3 percentage points on average, and 0.7 percentage points in low-heterogeneity counties. The average share of individuals reading at least one newspaper is 70%. Following the logic of Gerber and Green (2000)'s intent-to-treat calculation (see also Gentzkow *et al.*, 2011), my point estimate in low-heterogeneity counties corresponds to a $(0.7/0.70) = 1$ percentage point effect.

To get a better sense of what the magnitude of my estimates implies, I also compute the corresponding persuasion rate (DellaVigna and Kaplan, 2007; DellaVigna and Gentzkow,

[51] With only 11 elections in the sample, it is not possible to estimate equation (1.8) with a k higher than 1.



(a) ***Entire Sample***



(b) ***Low-Heterogeneity Counties***

Notes: The figures show coefficients from a regression of change in turnout per eligible voters, controlling for demographics, on a vector of leads and lags of the change in the number of newspapers (see equation (1.8) for details). Models include region-election fixed effects. Error bars are $+/-$ 2 standard errors. Standards errors are clustered by county. Time period is 1947-2008.

Figure 1.8: *Turnout and Newspaper Entries/Exits*

2010). The persuasion rate captures the effect of the persuasion treatment on the relevant behavior, adjusting for exposure to the message and for the size of the population left to be convinced. In my case, everyone is exposed the same way to newspapers so I do not need to adjust for exposure to the message. The change in behavior is from voting to not voting, so the set of potentially affected individuals is the set of those who turn out which represents on average 67% of the population. The 0.7 percent of eligible voter who do not vote as result of an increase in newspaper competition therefore implies a negative persuasion rate of $(0.7/0.67) = 1$ percent.

These estimates are lower bounds. The entry of a newspaper indeed raises the share of individuals reading at least one newspaper by about 8 to 12 percentage points. While the "intensive" margin of newspaper competition – through the decrease in the quality of the information provided to readers – has a negative effect on the probability of voting, this "extensive" margin – the increase in the number of readers – may have the opposite effect, since previously non-informed citizens now have access to a source of information. I am not capturing here the positive effect of the extensive margin of entry but while the focus of the literature has been on the extensive persuasion rate – media access leads to higher turnout at elections – I show that the intensive margin of the media – the change in media quality – can reverse the extensive effect.

Abstracting from the change in the share of hard versus soft news in newspapers, I finally compute the number of citizens who change their behavior from voting to not voting due to a decrease by one in the number of journalists. Depending on the specifications, the entry of a newspaper leads to a decrease by about 25 to 76 employees working for a newspaper in a given county, which corresponds to a decrease by about 9 to 27 journalists. As I underline above, the treatment effect of the entry of a newspaper is a 1 percentage point decrease in turnout, which represents on average 3,300 voters in a county. In other words, each newspaper cost cut of one journalist leads to about 122 to 367 citizens stopping turning out.

1.7 Discussion

1.7.1 Alternative Mechanisms

Clearly I have not established that my simple theoretical vertical differentiation framework is the only theory that could generate a negative correlation between newspaper competition and a decrease in turnout at elections. Other theories – I discuss them in turn in this section – may rationalize this finding. But I believe that it is difficult to find an alternative theory for the result about the effect of the interaction between the market structure and the extent of heterogeneity in the willingness-to-pay for quality.

The issue of a dumbing-down of the content of news has been raised both for newspapers and television. Zaller (1999) points out that increased market pressure is sometimes associated with cutbacks in reporting and editorial quality which lead to a race to the bottom (see also Arnold, 2002). Focusing on television, Popkin (2007) highlights that competition changes content; he shows that in the 1990s, network news cover less legislation than in the 1970s while celebrity coverage has increased (see also Hamilton, 2004; Jones, 2010). How to explain such a race to the bottom in quality selections? The argument I develop in this paper is that under low heterogeneity, competition leads to the division of the readership into smaller groups which reduces the revenues available to each newspaper to produce a high-quality paper. On the one hand, this simple theoretical framework rationalizes the observed decrease in the quality of competing newspapers compared to the monopolist in low-heterogeneity counties; on the other hand, it provides an explanation for the negative correlation between the number of newspapers in a market and the share of hard news in newspapers when consumers differ less in their taste for hard than for soft news.

An alternative argument is that the race to the bottom may simply reflect a general decline in tastes for hard news compared to soft news. I can rationalize this argument easily in the extension of my simple theoretical framework in which I divide newspaper's content between hard news and soft news. In this framework, under the assumption that the average willingness-to-pay for high-quality soft news (α) is higher than (rather than equal to) the average willingness-to-pay for high-quality hard news (θ), everything else being equal, newspapers choose to produce more soft news than hard news. This argument may explain part of the historical decline in hard news coverage, but not the impact of the market structure on the share of hard news, since the monopolist and the duopolists react to a change in the average willingness-to-pay the same way. On the contrary, my simple theoretical framework can account for the decrease in the share of hard news under increased competition.

A second argument that is often put forward in the literature is the role played by advertising: *"In broadcast markets, viewers aged 18-34 command higher advertising rates. News outlets may cater to the preferences of these younger viewers who are much less likely to express interest in traditional hard news stories."* (Hamilton, 2004). Recent papers in the literature model the market for news as a two-sided market and study how advertising affects content (see e.g. Ellman and Germano, 2009). Taking into account different values advertisers may place on different readers is beyond the scope of this paper but is the goal of ongoing research (Angelucci *et al.*, 2012). However, just as a general decline in tastes for hard news, advertising cannot account for the impact of the market structure on the share of hard news.

Finally, the observed race to the bottom in quality selections has been linked to the move from nonprofit to profit news organizations (see e.g. Hamilton, 2004; Jones, 2010). According to Hamilton (2004), *"media companies once covered public affairs in part because this brought prestige to the firm's owners and regulatory protection in the case of licensed broadcasters. Now that newspapers and television channels are part of large publicly traded firms, the focus on profits demanded by shareholders means less attention to public affairs reporting."* In my simple theoretical framework, I assume that newspapers are profit maximizing. This assumption is driven both by the move from nonprofit to profit news organizations in the United States and by the evidence from France where news organizations, especially local daily newspapers, are profit-maximizing firms. Having said that, assuming in my simple theoretical framework that newspapers are benevolent and operate under a positive-profit constraint will lead to similar predictions under low heterogeneity.

Polarization and self-segregation Importantly, one could argue that an increase in media competition may lead to changes in turnout at elections independently of any impact on the quality of information. The first channel through which it may happen is polarization and self-segregation. Through the implied fragmentation of the market, an increase in media competition may reduce common experiences and lead to the polarization of views among groups which avoid hearing information that might contradict their priors (Sunstein, 2002; Hamilton, 2004; Mullainathan and Shleifer, 2005; Prior, 2007; Sunstein, 2009). The widening of media choice and the elicited self-segregation of citizens can affect voter turnout in at least two ways. First, increased media choice leads to lower turnout among people who prefer soft news to hard news because it reduces their exposure to hard news and their acquisition of political knowledge (Prior, 2007). This argument is relevant in the case of television where there are entertainment channels entirely dedicated to soft news; less for local daily newspapers which always offer a mix of soft and hard news. Second, by confirming readers' prior beliefs, increased media competition may lead to an increase in the polarization of voter preferences and through this channel to an increase in political participation.[52] This view relies on the assumption that media outlets are biased; I show below that it is not the case of the French local daily newspaper industry. Moreover I do find that increased media competition leads to a decrease – not an increase – in participation.

Information overload Finally, even if an increase in media competition were to increase the amount of information available to readers it could nevertheless lead to a decrease in voter turnout through information overload. The burden of a heavy information load may indeed confuse readers and hamper decision making. We know from the literature on communication that the communication's informativeness increases with the receiver's attention effort and that *"informational overload may be as detrimental to a receiver as information*

[52]Determining whether citizens have polarized is still an open empirical question and is beyond the scope of this paper. For opposing views on the extent of political polarization in the United States, see e.g. Abramowitz (2010) and Fiorina and Abrams (2012).

underload" (Dewatripont and Tirole, 2005). Informational overload may indeed both distract attention and discourage absorption. Moreover, by being at odds with the information already held, an additional piece of information may obstacle the decision making. Anyhow these theoretical arguments cannot rationalize the empirical findings of the paper. First, I establish that under low heterogeneity competition leads to a decrease – not an increase – in the quantity of information provided by each competing newspapers. Whether summing information over competing newspapers leads to an increase or a decrease in the total amount of information available in a market is a complicated empirical issue that I do not tackle in this paper. But the existing empirical evidence shows that different media outlets tend to cover similar issues so if anything competition leads to a duplication rather than a proliferation of information. Moreover, the availability of more media outlets does not imply that citizens consume more outlets. In particular, evidence from the consumption of local daily newspapers in France shows that consumers tend to single-home.

1.7.2 External Validity

A final question is whether we should expect the patterns I have uncovered in the case of local daily newspapers and local elections in France to be repeated in other contexts. First, should these patterns hold in other countries? And second, should they still hold in the internet era? There are good reasons to think this could be the case.

My simple theoretical framework suggests that the effect of the market structure on political participation operates through two main ingredients: newspapers operate under increasing returns to scale and they face heterogeneous consumers that differ in their willingness-to-pay for quality. The negative effect of competition on turnout should be expected when heterogeneity in consumers' willingness-to-pay for quality is low. The extent of heterogeneity can vary from countries to countries and specific patterns will differ depending on context. The finding in Drago *et al.* (2013) of a positive effect of newspaper competition on electoral participation in Italy may be explained by high heterogeneity of Italian readership. More evidence is certainly in order and it will be interesting to interact the effect of market structure they obtain with a measure of heterogeneity to check whether it is indeed the case. Similarly, while Gentzkow *et al.* (2011) find no effect of newspaper competition on turnout at national elections, it would be of interest to test for the presence of an effect on local turnout and to study the interaction between the market structure and heterogeneity. The fact that newspapers operate under increasing returns to scale is obviously not specific to the French local daily newspaper industry – nor it is specific to the newspaper industry in general; other media outlets also face quality-dependent fixed costs.

Media bias A characteristic that may be more specific to French local daily newspapers is that they are independent – there is no political bias in these newspapers during my period of interest. As noted by Éveno (2003), since 1947 *"the story of biased newspapers has been the one of a slow decline"*. The last biased local daily newspapers disappeared in France in the 1950's. Moreover, according to Hamilton (2004), nonpartisan reporting also dominates in American newspaper markets.[53] (The picture is different in American television markets where the logic of niche programming has given rise to the Fox News Channel.) These empirical facts drive my choice of abstracting from horizontal differentiation in my simple theoretical framework.[54]

Adding horizontal differentiation to my simple framework will as a matter of course lead to new predictions. Determining how it will affect the quality of information is a complex issue. On the one hand, horizontal differentiation may allow newspapers to escape price competition and to increase their profits – and so the revenues available to produce high-quality. On the other hand, Neven and Thisse (1989) have shown that under vertical and horizontal differentiation, firms choose maximimal differentiation along one dimension

[53] According to Hamilton (2004), nonpartisan reporting emerged as a commercial product in American newspaper markets: *"In the late nineteenth century the rise of advertising, innovations in printing technology that increased the importance of scale economies, and demographic changes in the size of the reading public made it more profitable for newspapers to adopt "objective" or nonpartisan approaches to public affairs. (...) Objectivity evolved in the market as a commercial product, as publishers frequently found it more profitable to remove partisan coverage in order to attract more readers."* (p.25).

[54] Abstracting from horizontal differentiation also allows me to keep the model tractable while identifying a new effect of newspaper competition on the provision of information.

and minimal differentiation along the other. If the horizontal range is broad enough relative to the quality range, then both firms choose the same quality. Neven and Thisse (1989) abstract from the cost of producing quality but such a cost may lead both firms to produce the minimum quality, in line with the prediction of my simple framework.

Internet With the internet – of which some people believe it will allow voters to find all the information they need at the time of the elections – does the information provided in local daily newspapers still matter? There are various ways to tackle this issue. First, it is important to highlight that online news is still in its infancy (Gentzkow and Shapiro, 2013). Digital platforms account for only 8% of time spent consuming news in the US (Edmonds, 2013). The Internet represents less than 5% of the total revenues of the print media industry in France in 2012. Moreover I provide evidence in the Appendix of the relatively low internet penetration rate among French local daily newspaper readers compared to national daily newspaper readers. Using survey data, I also show that local daily newspaper readers think they are better informed through daily newspapers than through other media. Local newspapers are likewise still important for local news in the United States. According to the *State of the Media Report* 2013 of the Pew Research Center, *"papers in smaller markets, like those Warren Buffett is buying, can remain the go-to source for local news and a strong vehicle for local advertisers."*

Individuals are much more likely to search on the Internet for soft news or information about product purchases than for hard news (Hamilton, 2004). Internet expands the overall audience for the national daily newspapers but not for the local daily newspapers. In France, I find that in hard copy sales, the top five daily newspapers account for 9% percent of the total circulation of daily newspapers. The top one daily newspaper is a local newspaper – *Ouest France* – and accounts for 3.3% of this total circulation. Moreover, its circulation is 2.3 times the one of the top two newspaper, *Le Monde* (a national daily newspaper). The picture is different when I turn to websites. In terms of the number of visits to a website – or similarly of number of pages viewed –, the top five websites garner more than 53% of the total traffic, with 21% for the top one who is *Le Monde*. Moreover the most popular websites are websites of national daily newspapers.[55] The Internet is a way for consumers around the country to gain access to national papers and national information (or entertainment). Not to gain access to more local information.

Finally, especially for newspapers, the internet brings greater competition, raising the issue of the potential welfare losses that may arise from excessive competition and the duplication of costs. News sites – like newspapers – face fixed costs of content that depend on quality. Furthermore the internet increases the relative importance of these fixed costs: on the internet the cost of paper and distribution approach zero. Obviously this does not mean that the advent of the internet has not affected the provision of information; with the notable exception of Seamans and Zhu (2013), there is no empirical evidence on how media outlets adjust their content in response to increased competition in an online word.[56] But this means that the amount of information provided by local newspapers is still an important determinant of local political participation in the internet era.

1.8 Conclusion

In this paper, I investigate both theoretically and empirically how an increase in the number of newspapers in a market affects the quantity and type of news provided and, ultimately, changes in political participation. Modeling the production choices of newspapers in a vertical product differentiation framework, I show that if the heterogeneity of consumers' willingness-to-pay for a high-quality newspaper is low, an increase in the number of newspapers leads to a decrease in the size of newspapers (number of articles). Moreover, dividing the content of newspapers between hard news and soft news, I find that if consumers differ less in their taste for hard than for soft news, an increase in the number of newspapers may lead newspapers to produce a lower share of hard news. The evidence I

[55]Hamilton (2004) finds a similar picture for the United States: *"in hard copy sales, the top 5 among America's largest 100 newspapers account for 21.5 percent of the total circulation. In terms of linking activity, the top 5 websites of these newspapers garner 41.4 percent of the total traffic."*

[56]Esfahani and Jeon (2013) offer a model of multiple issues to investigate how news aggregators affect the quality choices of competing newspapers on the Internet.

obtain from a variety of identification strategies using a new dataset of French local daily newspapers between 1945 and 2012 is consistent with these predictions. I also find that under low heterogeneity, an increase in the number of local newspapers leads to a decrease in political participation at local elections.

The findings of this paper may benefit the public debate by questioning the view that more media competition is necessarily socially efficient.[57] They obviously do not imply that media competition is less desirable than media monopoly as the latter raises other important issues, in particular media capture (Besley and Prat, 2006) and monopoly rents. But they may have important policy implications. In my view, future research should study the relevance of policy interventions to compensate for the welfare losses that may arise from excessive competition under certain conditions, such as subsidies for the press, support for news agencies, tax credits for journalists or antritrust exemptions in the spirit of the American Newspaper Preservation Act (1970) permitting newspaper competitors to enter into a joint operating agreement and to combine business operations.

[57] See e.g. the Federal Communications Commission (FCC) in the United States which has sought to diffuse ownership of media outlets among multiple firms in order to diversify the viewpoints available to the public: *"In sum, the modified broadcast ownership structure we adopt today will serve our traditional goals of promoting competition, diversity, and localism in broadcast services. The new rules are (...) necessary in the public interest."* (Federal Communication Commission, 2003).

Chapter 2

The Long-Term Effects of the Printing Press in sub-Saharan Africa[1]

2.1 Introduction

This article delves into the relationship between newspaper readership and civic attitudes, and how it might affect economic development. To this end, we investigate the historical development of the media and study the long-term consequences of the early introduction of the printing press in the 19th century in sub-Saharan Africa.

The long-term consequences of religious incentives for economic success have been widely studied in the social sciences, the most well-known theory being Max Weber's "Protestant Ethic" (Weber, 1930). In addition, according to the principle of the *Sola Scriptura*, central to the Protestant doctrine, every Protestant should be able to read the Bible. Recent work has emphasized this incentive to increase literacy as an alternative explanation for the economic success of regions that first converted to Protestantism (Becker and Woessmann, 2009; Bai and Kung, 2011; McCleary and Pesina, 2012; Woodberry, 2012; Cantoni, 2013). These studies consider Protestant conversion as a whole. Instead of using such a binary approach, we exploit different types of missionary treatment. Missions invested in numerous

[1]Co-authored with Valeria Rueda

activities. We focus on the introduction of the printing press and show that it still has consequences on newspaper readership nowadays. We discuss other long-term effects of the printing press; we document in particular a strong association between proximity to a printing press and contemporary economic development, and show that newspaper readership might explain this positive relationship. For this purpose, we built and geocoded an entirely new dataset of Protestant mission settlements. For each settlement, we document the exact geographic location, the educational, health-related and printing investments, as well as geographic and historical characteristics. Producing these data is our first contribution. Our second contribution is to identify the long-term effects of the printing press using a sharp empirical strategy relying on our reading of history.

Protestant missionary activity played a central role in the development of a written tradition in sub-Saharan Africa. Because they needed to print Bibles and educational material, Protestant missionaries were among the first to bring the printing press to Africa. They made it accessible to the indigenous populations by both exposing them to the printing technology and granting them access to it (Woodberry, 2012). Investing in printing necessitated a large fixed cost. Protestant missionaries imported the press from Europe and it could not be easily exported to other regions due to transportation costs, and to the specific know-how required to use it. This early availability of the printing technology enabled the local development of a culture of writing and information diffusion, beyond the single field of religious literature (Reports of the LMS, 1913). Publishing material for Africa was indeed central to the missionary ambitions since the commencement of their work (Fahs and Davis, 1935); mission presses not only published Christian texts but were also the first to produce all sorts of written material and newspapers in indigenous languages (Maake, 2000).[2] Local newspapers thus developed first around missionary printing presses, yielding a persistent geographic concentration of publishing activities and newspaper readership.

[2]Fahs and Davis (1935) mention that "*the term "Christian literature" was used* [by missionaries on the field] *in the widest sense, included all printed matter needed for the pioneer work of evangelization and for the development and expansion of the Church, from tracts, leaflets, school books to such publications as in the strict sense of the matter may be designed "literature"*".

Using contemporary individual-level data from the Afrobarometer, we find that proximity to the closest location of a mission with a printing press has a positive and statistically significant impact on the probability of reading the news. A one-standard deviation increase in the proximity to a mission with a printing press increases the probability of reading the news on a monthly basis from 3 to 14% of a standard deviation, depending on the specifications. In contrast, proximity to a mission without a printing press has no significant impact on newspaper readership. Moreover, we also find that a one-standard deviation increase in the proximity to a mission with a printing press increases contemporary economic development from 10 to 15% of a standard deviation. We show that newspapers might explain this association.

Our econometric analysis attempts to move beyond two forms of selection. First, historical and geographical characteristics might have determined mission station location preventing us from comparing regions close and far from these settlements. Protestant missionaries did choose to locate in geographically favored areas (Johnson, 1967; Nunn, 2010). Second, Protestant stations invested in different activities such as printing, health and education. There may be endogenous selection of missions into printing.

To address selection from missions' location we restrict our sample of analysis to regions near historical mission settlements. These are regions for which there is a Protestant mission within alternatively a 200-kilometer (124 miles), 150-kilometer (93 miles) and 100-kilometer (62 miles) radius. Because regions near Protestant missions shared similar geographic, institutional and cultural environments, this restriction isolates the specific effect of the printing technology from other possible long-term determinants of newspaper readership embedded in specific mission locations.

To address selection of missions into printing, we first control for observable covariates. The set of observable covariates include geographic and historical characteristics as well as distance to historical mission stations that invested in health and educational facilities.[3]

[3] In the online Appendix, we also use insights from Altonji *et al.* (2005) and Oster (2013) to assess the bias due to unobservables using the sensitivity of the treatment to added controls. From this approach, it seems unlikely that the entire estimated effect of the distance to the printing press is driven by unobserved variables.

Despite our attempts to control for observable factors, our estimates might be driven by unobserved determinants of long-term development and proximity to a historical mission settlement endowed with a printing press. To deal with this problem, we instrument the proximity to the closest printing press. In the 19th Century, missionaries formed numerous societies that were not equally inclined to the same activities. For each mission, we estimate the probability that it was endowed with a printing press using the share of missions from the mission's society equipped with a printing press in all the regions of the world *outside* sub-Saharan Africa. Our results are robust to the IV approach.

Related literature Woodberry (2004, 2012) and Woodberry and Shah (2004) first document the role of Protestant missionaries on the consolidation of liberal democracy and emphasize the introduction of the printing press and newpapers as a potential mechanism. They identify the relationship between Protestantism and democracy using a cross-country identification strategy. On the contrary, we estimate the long-term effects of the printing press in sub-Saharan Africa using a variety of *within-mission* empirical strategies; in particular, our econometric analysis moves beyond selection from missions's location and selection of missions into printing. Our empirical work relies on the building of a new geocoded dataset and on the use of several previously-unexploited historical archives. Moreover, we explore various channels that may explain persistence and document the effect of the printing press on economic change.

Our results also complement a growing literature documenting the persistence of development paths in developing countries (Acemoglu *et al.*, 2001; Glaeser and Shleifer, 2002; Porta *et al.*, 2008). While this literature mainly compares regions with different institutional or colonial history, we highlight access to the printing press as a specific long-term determinant of newspaper readership, political participation and economic development, even within regions sharing the same institutional framework. As noticed by Feyrer and Sacerdote (2009), Huillery (2009) and Huillery (2011), historical events can explain heterogenous development dynamics. Recent micro-oriented studies therefore isolate specific channels through which a development dynamic was durably established (Nunn, 2008; Huillery, 2009; Dell, 2010;

Cogneau and Moradi, 2011; Alesina *et al.*, 2011; Michalopoulos and Papaioannou, 2011, 2013; Voigtländer and Voth, 2012). Of particular importance for sub-Saharan Africa are early investments. Wantchekon *et al.* (2012) highlight for example the durable impact of the first schools in Benin. With the notable exception of Dittmar (2011), who shows that European cities where printing presses were established in 1450-1500 grow faster between 1500 and 1600 than similar cities which were not early adopters, there has been no research on the long-term consequences of the printing press. While the focus of Dittmar (2011) is on the 16th and 17th Century Europe, we identify the effect of the early arrival of the printing press on contemporary outcomes in sub-Saharan Africa. Consistently with the hypothesis from historians of sub-Saharan Africa (Omu, 1978; Tudesq, 1995), we are the first to show empirically that proximity to the missionary press is associated with higher newspaper readership today. Moreover, we find that contemporary economic development is higher in regions close to the missionary press. Media and the quality of information have recently been shown to affect economic and democratic development (Casey, 2013)[4]. Using different econometric specifications, we show that newspaper readership might be a channel explaining the relationship between proximity to the printing press and contemporary economic development.

The rest of the paper is organized as follows. Section 2.2 presents some historical background on missionary history in sub-Saharan Africa and the development of newspapers. Section 4.3 describes the data, in particular our new geocoded dataset of missions and discusses the determinants of missions' location and investments. In Section 2.4, we provide empirical evidence of the long-term impact of proximity to a printing press on newspaper readership. We discuss extensively endogenous selection of missions into printing. Section 2.5 presents the long-term relationship between proximity to the printing press and economic development, and analyzes channels explaining this relationship. Section 2.6 concludes.

[4]See also the first chapter of the dissertation.

2.2 Historical Background and Persistence

The introduction of the printing press Protestant missionaries pioneered in the development of a written tradition for sub-Saharan African languages. Wherever they went, Protestants quickly formalized indigenous languages and printed Bibles and educational material in these languages. Following the principle of the *Sola Scriptura*, every Protestant should be capable of reading and interpreting the Bible (Eisenstein, 1980; Woodberry and Shah, 2004; Woodberry, 2012). On this topic, Eisenstein (1980, p.158) writes: *"(...) Christian missionaries continued to set up printing presses in remote parts of the world to turn out Gospels and Psalters as had been done in Mainz four hundred years earlier*". On the contrary, for the Catholic religious practice, reading the Bible is not necessary. This difference between Protestants and Catholics appears on the title page illustration of *Actes and Monuments*[5] (Foxe and Day, 1563) showing *"devout Protestant with books on their laps and Catholic with prayer beads in their hands"* (Eisenstein, 1980, p.173).

Protestant missions facilitated the access to the printing press, acting as the intermediaries of its diffusion. For example, in South Africa, several mission societies acquired the printing press in Cape Colony between the 1820s and the 1870s. The Methodists acquired a printing press in Grahamstown in the 1830s. The Anglicans acquired presses for several stations in the eastern Cape in the 1860s and 1870s. In the later 19th and early 20th centuries, missionary societies outside the Cape Colony were also active in publishing, especially in Natal (Switzer, 1984).

Investing in printing technology was a better strategy than importing books, as transportation was long and native languages were mostly unknown in Europe. Due to technological constraints, printing presses could hardly be built in sub-Saharan Africa and had to be imported from Europe. Missionaries mainly imported hand press machines; nevertheless, importation was far from easy.[6] Wooden printing presses were, for instance,

[5] The *Actes and Monuments*, popularly known as Foxe's *Book of Martyrs*, is a work of Protestant history and martyrology by John Foxe, first published in English in 1563.

[6] At the time of Protestant missions' settlement in sub-Saharan Africa, there existed three kinds of printing

highly inflammable materials. In 1819, Thomas Stingfellow and Robert Godlonton, both English settlers and qualified printers, set sail for South Africa with a large crate containing a second-hand wooden press. Their "inflammable" machine was however impounded in Table Bay by the Acting Governor, calling a halt to their printing project before it even started (Gordon-Brown, 1979). Similarly, the Wesleyan missionaries in Grahamstown (South Africa) decided to import an iron printing press at the end of the 1820s. But their project was almost as complicated. When Reverend Stephend Kay arrived with the machine in 1830, the missionaries realized that certain characters required for the Xhosa language were missing from the typing range. The printing press therefore could not be used for almost three years, the time it took for the missing material to arrive to Grahamstone.

This anecdotal evidence illustrates the complexity of starting the printing activity in sub-Saharan Africa. The printing press was, furthermore, a costly object to transport because of its size and weight. It is difficult to have exact information on the size of the press. Some useful information is nevertheless given in Moran (1973) who details the sizes as found in catalogs. The platen of one of the smallest wooden presses found in the 1820s (the *Brooke*) was 30cm×3.8cm×45cm (1ft×1$\frac{1}{2}$in×1ft5in) while it was 91cm×30cm (3ft×11$\frac{1}{2}$in) for the largest one. Iron presses were larger. For example, the size of the Columbian press introduced between 1812 and 1814 and which, according to Moran (1973),*"looks much like others of the period"*, ranges from 53cm×40cm (21in×16in) to 106cm×68cm (42in×27in).

Printing presses were also costly. According to Moran (1973), at the beginning of the 19th Century, wooden presses cost between £60 and £70. When Stanhope introduced his first iron press around 1800, its price was £90. The price began to drop with competition; in 1808, however, it still ranged from £21 to £73. A few years later, at the end of the 1810s, the price of the Columbian press, another iron model, ranged from £100 and £125. In 1820 the price was still above £75. In the 1840s, the Albion press – following the Columbian Press – varied in size from Amateur (15cm×12cm or 7×5$\frac{1}{2}$in) to Double Royal (100cm×58cm or

presses: the wooden press directly inherited from the old Gutenberg's printing press (Clair, 1976); the iron press, the most famous one being the Stanhope press which appeared around 1800; and the more technological steam press that uses a rolling cylinder in printing to overcome excessive manual strain.

40in×23in). The price of the Double Royal was £75.[7] In 1830, the average annual income in the United Kingdom per adult was £30, while the average annual wage was £20. The average worker (blue-collar) annual wage was £15.[8] According to Maddison's historical per capita GDP series, average incomes in Africa around 1820 were about five times smaller than in the United Kingdom. In other words, a printing press cost on average twenty-five years of a worker's wage.

Printing presses were costly and sizable and missionaries had to import them from Europe. Furthermore, specific knowledge was required to use them. When bringing a printing press to sub-Saharan Africa, the owner had to train apprentices and do much of the mechanical work himself: *"the editor, printer, publisher and proprietor were all combined in one person"* (Gordon-Brown, 1979). Printing presses were often operated by settlers who had experience on a printing office in England. Moreover, specific educational investments had to be made. Printing schools were established by Protestant missionaries for the indigenous population to acquire the specific knowledge required. In 1896, four printing schools were already active in South Africa (Cape Colony), Zanzibar and Malawi (Lake Nyasa) with close to 300 students (Church Missionary Society, 1896). As a consequence, printing presses were not available to the native population outside Protestant mission stations with a printing press.

The introduction of the first newspapers Because Protestant missionaries made printing presses available to the indigenous population, most of the first indigenous newspapers were printed and sponsored by mission centers. Woodberry (2012) qualifies conversionary Protestants as being *"a crucial catalyst initiating the development and spread (. . .) of newspapers"*.

The first newspaper intended for black readers, the *Umshumayeli Wendaba* ("Publishers of the News"), written in Xhosa, was published as an irregular quarterly in 1837 and printed

[7]Not to refer to the prices of the cylinder machine which were used in the United States at the time. The simplest Koenig machine, the single cylinder, cost £900. A double machine cost £1,400 and the most advanced one £2,000.

[8]See e.g. Piketty and Zucman (2014).

at the Wesleyan Missionary Society in Cape Colony.[9] The *Iwe Irohin* ("The Newspaper") was founded in 1859 as a publication directed by Reverend Henry Townsend from the Anglican Church missionary society in Nigeria. *Isigidimi samaXhosa* ("The Xhosa Messenger"), the first African newspaper edited by Africans, was first released in January 1876 and printed at the Lovedale Mission Press in South Africa. Eight years later, in November 1884, the English/Xhosa weekly *Imvo Zabantsundu* ("The African Opinion") was published. It was the first black-owned newspaper in South Africa. The *Imvo Zabantsundu* was edited by John Tengo Jabavu, former editor of the *Isigidimi*, and perhaps *"the most widely known mission-educated African in Southern Africa"* at the time (Switzer and Switzer, 1979).

In regions where Protestant missions were less active, the first newspapers appeared only at the beginning of the 20th Century and no indigenous newspapers were created before World War I. Before the war, the printing presses were mostly owned by the colonial powers. The first paper in Abidjan (Ivory Coast) to be owned and edited by an African, the *Eclaireur de la Cote d'Ivoire*, was first published in 1935 (Mytton, 1983).

This lag of more than one century in the timing of creation of the first indigenous newspapers might explain the persistent effect of the proximity to a printing press on newspaper readership today. Newspapers take time to consolidate. In most sub-Saharan African countries, the newly-established government tried to take control of the press after independence. These nationalizations did not succeed in countries where newspapers were well established, stable and independent before colonization. In Nigeria, for instance, despite the 1966 *coup d'état*, the ensuing military regime and the development of a state-owned press, independent newspapers managed to survive. Similarly, even during Apartheid in South Africa, the black press and anti-Apartheid white-owned presses continued to exist. *The Daily Dispatch*, the *SASO Newsletter* or *The World* regularly diffused their anti-Apartheid stances. This was not the case in former French colonies.

[9] The London Missionary Society and Methodist missions also produced the earliest journals aimed at the Tswana Christian community from their stations at Kuruman and Thaba'Nchu. *Mokaeri Oa Becuana, Le Muleri Oa Mahuku* ("The Teacher of the Bechuana, the Announcer of the News"), which started in 1857, is regarded as the oldest newspaper in the Tswana language (Switzer, 1984).

Reading habits exhibit strong persistence over time. A survey on newspapers made by the Lumina Foundation across Lagos, Enugu, Oyo, Edo, Kogi, Kaduna and the River States, highlights the persistence of reading habits in southern and middle-belt Nigeria. 59% of the respondents replied that they read newspapers as a family-inherited culture (Fraser, 2008).

The persistence of newspaper readership is of particular importance today despite growing questioning of the future of newspapers in the internet era. Sub-Saharan Africa is one of the few places in the world where the newspaper market is still growing. This market expands as literacy steadily increases whereas other media like television or internet require capital that most sub-Saharan Africans do not have. Moreover, as suggested by Bratton *et al.* (2005), it is harder for governments to control newspapers while they can control radio or television by restricting supply and imposing a government monopoly.

Testing for the long-term impacts of the historical printing press on newspaper concentration ideally requires information on newspaper supply. Such information is not available at the local level in sub-Saharan Africa. The few datasets available only provide information on the main national newspapers. In the Appendix, we provide cross-country evidence of the persistence of newspaper supply.[10] Figure B.5 shows the cross-country correlation between the number of newspapers that have existed and the average distance of the cities surveyed in the Afrobarometer to the closest historical mission settlement with a printing press. The figure displays a negative correlation between the average distance to the printing press and the total number of newspapers recorded. Figure B.6 shows the correlation between the date of publication of the first newspaper and the average distance of the cities surveyed in the Afrobarometer to the closest historical Protestant mission station with a printing press. We observe a positive correlation between the distance to the printing press and the publication date of the first newspaper: the closer a location is to a historically attested printing press, the sooner the first newspaper is recorded. This suggestive evidence supports the notion of the early emergence of newspapers around mission stations and the persistence of the

[10] In the Appendix, we present the few data sources on sub-Saharan African newspapers that are available and that we digitize and merge together.

concentration pattern. In the remainder of the paper, newspaper readership is our variable of interest.

2.3 Data and Missionary Locations

2.3.1 Data

2.3.1.1 Historical data

Missionary activity We construct the mission-level data from the *Geography and Atlas of Christian Missions* (Dennis *et al.*, 1903). We geocode the maps of sub-Saharan African regions from this atlas. The maps locate all the Protestant mission stations in 1903 (an example of these maps is provided in the Appendix Figure B.2).

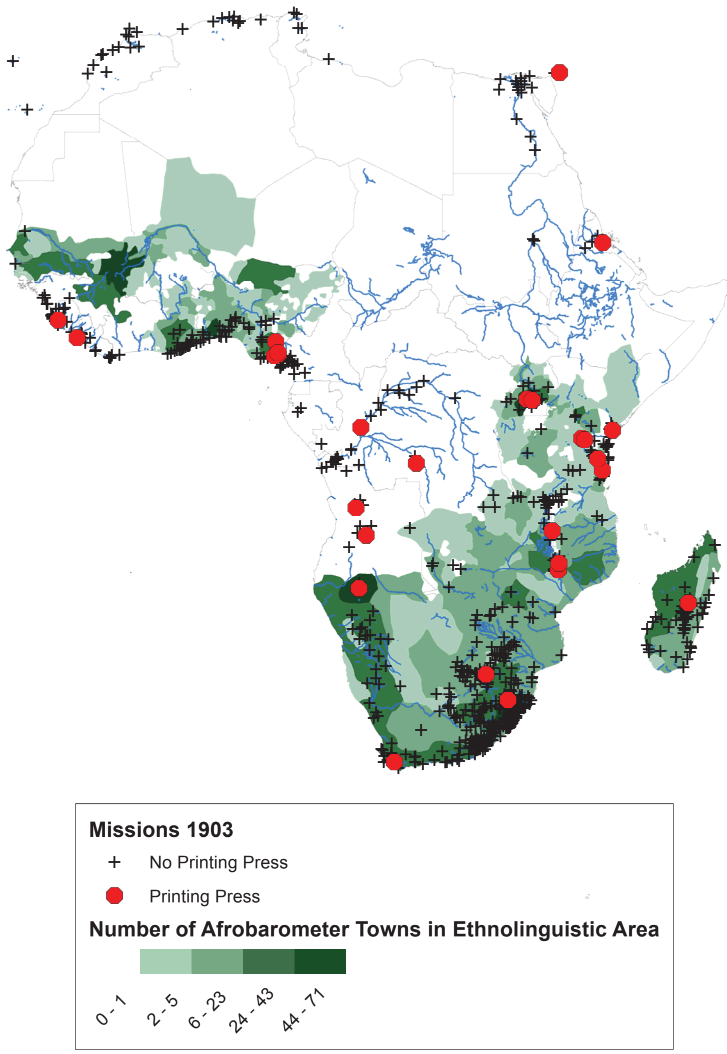
As opposed to other available geographic datasets of Protestant missions (Nunn, 2009a), ours contains detailed information for each mission settlement. In the *Geography and Atlas of Christian Missions*, each mission station is uniquely identified in a statistical appendix providing information on the mission's size (number of students, of missionaries, etc) and a detailed record of its activities and investments. For example, we know whether each mission had a printing press, a school, a high school, a dispensary, or a hospital. The exhaustive list of variables and a reproduction of one page of the statistical index are provided in the Appendix Figure B.1. We digitize this information for the entire world and geocode it for Africa. Our sample of sub-Saharan African missions includes a total of 723 Protestant missions out of which 27 were equipped with a printing press in 1903. Figure 2.1 shows the location of mission stations and their printing presses in 1903. This dataset is, to the extent of our knowledge, the most exhaustive recording of missionary investments in the world, and it is geocoded for Africa. We hope this dataset will be of use for future research.

Since very few Catholic missions are recorded in the *Geography and Atlas of Christian Missions*, we use data from Béthune (1889) to locate them. This source does not provide information on the investments conducted. This is not an empirical issue since Catholic missionaries had no role in bringing the printing press. Moreover, our specifications always controls for the distance to the closest Catholic mission.

Population density Historical population density comes from the HYDE 3.1 database (Goldewijk *et al.*, 2011). This database provides rasters of estimated historical population density on a 0.5 by 0.5 degree latitude longitude grid. The estimates are the results of a bio-geographic model that combines information on population density at the national and subnational levels with climatic and geographic data to infer a local estimate of the population density (Goldewijk, 2005; Goldewijk *et al.*, 2011). For the national-level population density, data are from the Maddison Project Database, McEvedy and Jones (1978) and Livi-Bacci (2001). Sub-national level data come from censuses. The HYDE 3.1 database provides 56 rasters covering the period from 10000 BC to AD 2000. According to the documentation, the data is reliable for Africa starting from AD 1700. Figure B.3 in the Appendix gives examples of the population density maps in 1700, 1800, 1900 and 2000. We extract all these estimates in a buffer of 10 km around each mission and around each town from the Afrobarometer.

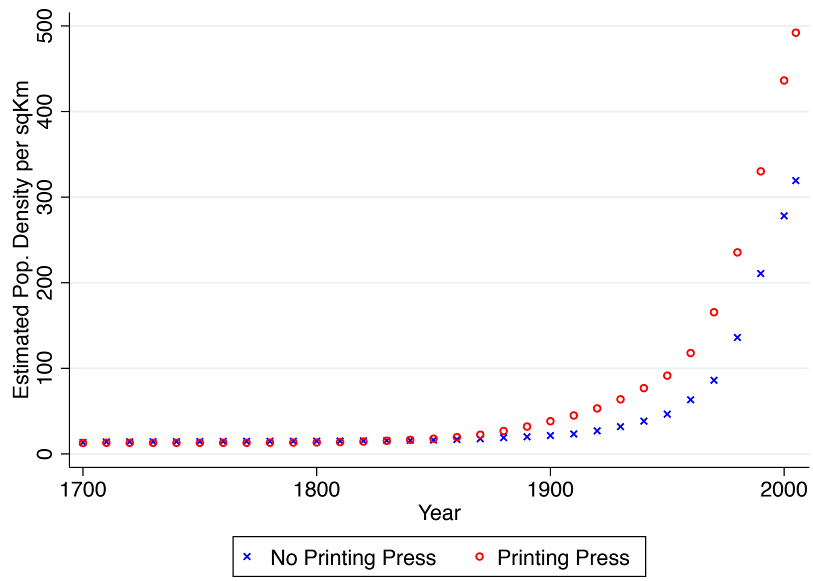
Figure 2.2 shows the evolution of population density, as estimated in the HYDE 3.1 database, around missions depending on whether they had a printing press. Missions start to diverge in the late 19^{th} Century. Population density is estimated to be systematically higher around missions with a printing press *after* missions started to settle (the average arrival date of missions in Africa is 1850). Such divergence between missions with and without the printing press supports our hypothesis of a positive impact of the missionary printing press for long-term development. However, this is only suggestive evidence.

Publication records We gather information on the number of publications printed at the mission press until 1923, twenty years after the publication of *Geography and Atlas of Christian Missions*. The *Bibliography of Christian Literature* (Rowling and Wilson, 1923) inventories all the books and reviews, religious or not, published by the missionaries. From this source, we identify 18 presses from our original sample that had a publication record in 1923.



Notes: This map is a digitized and geocoded version of plates 14 to 18 of Dennis *et al.* (1903). The geocoding was conducted by the authors.

Figure 2.1: *Mission Stations With and Without a Printing Press in 1903*



Notes: The graph plots the time series of average population density as estimated in the HYDE database, in a 10 km buffer around each mission station. The sample is split in two groups depending on whether the mission had a printing press in 1903.

Figure 2.2: *Population Density around Missions, using HYDE 3.1 data*

These printing presses were probably the most productive or the ones with the most stable production across time.

Historical controls The *Ethnographic Atlas* (Murdock, 1967) provides precolonial characteristics at the ethnic group-level such as initial population density. The slave trade data come from Nunn (2008). We geocode this data at the mission-level. Geocoded town-level data are from Nunn (2008).

2.3.1.2 Contemporary data

Newspaper readership Data on newspaper readership are from the 2005 Afrobarometer surveys. There are 17 sub-Saharan African countries in these surveys: 10 former English colonies (Ghana, Kenya, Lesotho, Malawi, Nigeria, South Africa, Tanzania, Uganda, Zambia and Zimbabwe), 4 French (Benin, Madagascar, Mali and Senegal), 2 German (Botswana and Namibia) and 1 Portuguese (Mozambique). Surveys are based on interviews conducted in the local languages from a random sample of either 1,200 or 2,400 individuals of voting age in each country. Overall, they cover approximately 21,000 individuals sampled to constitute representative groups at the national level.

The Afrobarometer provides individual-level subjective data on media consumption and civic attitudes. On average only 34% of the individuals surveyed read a newspaper at least once a month. The Afrobarometer also provides information on a set of individual controls: education, age, sex and ethnicity, among others. This data is geocoded at the district level.[11] Table B.2 in the Appendix provides summary statistics for these variables.

Light density at night To proxy for contemporary economic development, we follow Michalopoulos and Papaioannou (2013) and use satellite images of light density at night. The data come from the Defense Meteorological Satellite Program's Operational Linescan System of the National Geophysical Data Center. This system reports images of the earth at night captured from 8:30pm to 10:00pm local time. The satellite detects lights from human settlements, fires, gas flares, lightning, and the aurora. The measure ranges from 0 to 63 and is calculated for every 30-second area (approximately 1 square kilometer). The resulting annual composite images of lights are created by overlaying all images captured during a calendar year, dropping images where lights are shrouded by cloud or overpowered by the aurora or solar glare (near the poles), and removing ephemeral lights like fires and lightning (the map used is presented in the Appendix Figure B.4). We construct average light density in 2012 for each mission and each Afrobarometer town. This measure is the average light density reported on the night light raster in a 10 km buffer around each location. Following Michalopoulos and Papaioannou (2013), we use the natural logarithm of average light density.

Appendix Figure **??** plots our measure of average light density for Afrobarometer towns as a function of the distance to the printing press. The plot presents first suggestive

[11] Individual-level readership data allows us to control for other individual characteristics. There is no data on African newspaper circulation available at the district level. Moreover, as our identification strategy uses precise geographic variation, we need extensive district-level information and such information is not available for newspaper circulation.

Table 2.1: *Summary Statistics of the Distance from the Afrobarometer Town to the Closest Mission and to the Closest Printing Press.*

	Mean	sd	Median	Min	Max
Distance to Mission, 100km	1.338	1.733	0.710	0.007	12.897
Distance to Printing Press, 100km	4.456	3.014	3.705	0.016	16.891
Mission $<$ 150 km	0.718	0.450	1.000	0.000	1.000
Mission $<$ 150 km and Printing $<$ 150 km	0.109	0.312	0.000	0.000	1.000
Observations	21330				

Notes: The table gives summary statistics for the distance of Afrobarometer towns to Protestant missions. The variables in the first two rows respectively describe the distance to the closest mission and the closest mission with a printing press in hundreds of kilometers. The last two rows describe two binary variables equal to one if the city is located in a 150 km radius of respectively any mission or a mission with a printing press.

evidence of the negative relationship between the two variables. In Section 2.5.3, we present econometric evidence identifying this relationship.

Geographic characteristics Finally, to control for geographic characteristics at the town and mission level, we use the *Global Agro-Ecological Zones* (GAEZ) data. The data are geocoded and provide information on annual precipitation levels, the average suitability for rainfed crops, the number of agriculture growing days per year and the accumulated temperature in the year.

2.3.2 Determinants of Missions' Location and Investments

Protestant missions were the first to make the printing press available to the indigenous population and to sponsor the first indigenous newspapers. Before turning to the empirical analysis, we analyze the determinants of mission location. We also compare missions that invested in the printing technology and missions that did not. On average, towns from the Afrobarometer are located 133.8 km away from the closest mission settlement and 70% of them are located 150 km away or closer to the closest mission settlement (Table 2.1). As a baseline, we use the 150 km threshold to define towns close to a mission.

Mission location A number of factors played a role in determining the location of mission settlements. Among them are access to a clean water supply, the ability to import supplies from Europe, the abundance of a fertile soil that could be used to grow crops, and a high altitude with a temperate climate (Johnson, 1967). Moreover, mission locations exhibited a form of path-dependence. The routes of initial missionary explorers determined which parts of Africa were the best-known to Europeans, as well as the locations of the earliest mission stations from which larger networks of stations were developed. The colonial railway network is another factor that affected mission locations, as well as the slave trade (Johnson, 1967; Nunn, 2010).

These known trends are for the most part confirmed in our data. In Table 2.2 we perform a t-test on the equality of means for geographic and historical characteristics of towns located near (less than 150 km) and far (more than 150 km) from a historical mission settlement. As for the geographic characteristics, we find that missions locate in places with a lower prevalence of malaria and a more favorable climate (measured by the accumulated temperature and the annual precipitation level). They also locate in places more suitable for agriculture (measured by the suitability for rainfed crops and the number of agricultural growing days). Moreover, they locate closer to the coast. As for the historical determinants of mission location, slave exports are higher in places near missions. We also find that missions have a higher probability to be located near historical railway networks, and a lower probability to locate near an explorer's route.

An open question in the literature is the general effect of population density. Some missionaries intentionally built missions in more remote locations where the "word of God" otherwise would not have reached; whereas other missionaries recognized the benefits associated with dense populations and targeted these groups (De Gruchy, 1999; Nunn, 2010).

According to Table 2.2 regions near historical mission settlements had on average a higher population density and more favorable geographic conditions. In our empirical analysis we only focus on regions near historical mission settlements. Moreover, our specifications always control for all the geographic and historical characteristics described in Table 2.2.

Location of the printing press Did missions with a printing press locate in regions with specific geographical or historical characteristics correlated with determinants of newspaper readership? Table 2.3 compares the geographic and historical characteristics of missions with and without a printing press and perform a t-test on the equality of means. Missions with the printing press were not, on average, located in more geographically favored areas. None of the geographical indicators are significantly different between the two groups, except for malaria ecology which is higher for missions that invested in the printing press.

Historical characteristics exhibit a different pattern. Slave export and railway contact have similar means between the two groups, as well as initial population density. On the contrary, missions with a printing press have more favorable historical characteristics: they are closer to historical cities and explorer routes. All our specifications control for these characteristics.

2.3.2.1 The printing press and other investments

Did missions with a printing press conduct different types of investments or have different characteristics? Table 2.4 presents descriptive statistics comparing investments and characteristics of missions with and without a printing press. Mission characteristics are similar between the two groups, except that missions with a printing press also have a much higher probability of being Bible Societies.

Missions with a printing press have on average more schools, both in level and per student than missions without, as well as more teachers per student. We use various empirical strategies to check that our results are not driven by these higher investments in education. Finally, missions with a printing press have more health facilities in level. However they do not invest more in health per capita. Our specifications always control for missions' characteristics and investments.

Table 2.2: *Determinants of the Location of Missions*

	No Mission	Mission	Diff/se
Geographic Characteristics			
Accumulated Temperature / 1000	10.921	13.476	-2.555***
			(0.76)
Annual Precipitation level / 1000	1.227	1.287	-0.060
			(0.11)
Suitability for Rainfed Crops	5.606	5.046	0.560***
			(0.10)
Number of Growing Days / 100	1.803	4.182	-2.379*
			(1.17)
Distance Capital, 100km	4.451	3.142	1.309***
			(0.15)
Distance Coast, 100km	5.768	3.402	2.366***
			(0.16)
Malaria	17.025	9.723	7.302***
			(0.49)
Historical Characteristics			
Slave Exports, per capita	0.083	0.116	-0.032**
			(0.01)
Railway Contact	0.288	0.470	-0.182***
			(0.02)
Explorer Contact	0.582	0.357	0.224***
			(0.02)
Initial Population Density	12.753	20.700	-7.948**
			(2.59)
Distance 1400 City, 100 km	3.394	5.106	-1.712***
			(0.15)
Distance 1800 City, 100 km	4.367	7.320	-2.953***
			(0.30)
Observations	1979		

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table compares geographical and historical characteristics of places with and without missions. Column 1 presents the results for places without missions. Column 2 presents the results for places with a mission. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Appendix.

Table 2.3: *Determinants of the Location of Missions With a Printing Press*

	No printing	Printing	Diff/se
Geographic Characteristics			
Accumulated Temp /1000	12.808	13.184	-0.376
			(3.025)
Annual Precipitation/ 1000	1.246	1.384	-0.138
			(0.441)
Suitability for Rainfed Crops	4.992	4.750	0.242
			(0.356)
Number of Growing Days / 100	3.952	2.192	1.761
			(4.842)
Distance to Capital, 100 km	2.702	2.655	0.047
			(0.374)
Distance to the Coast, 100 km	2.310	2.747	-0.437
			(0.534)
Malaria Ecology	5.187	10.295	-5.108***
			(1.509)
Historical Characteristics			
Slave Exports, per capita	0.074	0.042	0.031
			(0.107)
Railway Contact	0.237	0.107	0.129
			(0.081)
Explorer Contact	0.143	0.286	-0.143*
			(0.069)
Initial Population Density	11.803	13.760	-1.958
			(8.008)
Distance to 1400 City, 100 km	8.872	6.969	1.903*
			(0.932)
Distance to 1800 City, 100 km	15.587	10.704	4.883**
			(1.890)
Observations	679		

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares geographic and historical characteristics of places where missions with and without a printing press locate. Column 1 presents the results for missions without a printing press. Column 2 presents the results for missions with a printing press. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Appendix.

Table 2.4: *Characteristics and Investments of Missions With and Without a Printing Press*

	No Printing	Printing	Diff/se
Mission Characteristics			
Arrival Date	1878	1872	7
			(4)
Bible Society	0.05	0.36	-0.30***
			(0.05)
Number of Native Workers	3.42	1.79	1.64
			(3.20)
Total Population	328	413	-86
			(120)
Investment in Education			
Schools	0.26	1.64	-1.38***
			(0.17)
Number of Students	321	397	-76
			(119)
Schools per Student (%)	0.32	1.35	-1.03**
			(0.37)
Teachers per Student (%)	10.09	18.86	-8.77*
			(4.38)
Investments in Health			
Health Facilities	0.19	1.46	-1.28***
			(0.14)
Physicians per Capita (%)	0.35	0.95	-0.61
			(0.58)
Health Facilities per Capita (%)	1.52	2.30	-0.78
			(1.27)
Observations	679		

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares the characteristics and investments of missions with and without a printing press. Column 1 presents the results for missions without a printing press. Column 2 presents the results for missions with a printing press. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Appendix.

2.4 Newspaper Readership and the Printing Press: Empirical Analysis

2.4.1 Specification and Identification Strategy

Let i index individuals, j index the village in which individuals live[12], e index the ethnicity and c index the country. Standard errors are clustered at the village level.

Equation 2.1 describes our preferred identification equation:

$$\begin{aligned}\text{News}_{ijec} = & \,\alpha\,\text{Distance Printing Press}_j \\ & +\beta_1\text{Distance Mission}_j + \boldsymbol{X_i'\beta_2} + \boldsymbol{Y_j'\beta_3} + \boldsymbol{Z_e'\beta_4} + \delta_c + u_{ijec}\end{aligned} \tag{2.1}$$

"Distance Printing Press$_j$" is the logarithm of the distance from village j to the closest mission with a printing press. Distances are measured in kilometers. The parameter α is our parameter of interest. It captures the impact of the proximity to a printing press on newpaper readership today.

"Distance Mission$_j$" is the logarithm of the distance from village j to the closest mission. The distances are computed using the geocoded information described in Figure 2.1 and Section 3.1.

We control for a large set of covariates that might determine individual behaviors today and historical mission settlement. The choice of the control set is inspired from Nunn (2008) and Michalopoulos and Papaioannou (2011).

The vector of individual controls $\mathbf{X_i'}$ includes the age of the surveyed individuals, their age squared, their sex, their level of education, their religion (two binary variables indicating whether the individual is Protestant or Catholic), their television and radio consumption, and two indices ranging from 0 to 4 indicating the intensity of cash and water constraints. These two indices are proxies for living standards and geographical constraints.[13]

[12]In the Afrobarometer, individuals are assembled by the smallest unit among villages, cities or districts. We defined this unit using the latitude and longitude provided in the Afrobarometer. We call "village" this unit in the remainder of the paper.

[13]This set of individual level controls is similar to the one used in Nunn and Wantchekon (2011).

The vector of village-level controls $\mathbf{Y}_\mathbf{j}'$ includes a wide range of historical and geographical factors that may have played a role in determining both mission center locations and long-term economic development. At the village level, we control for the distance to the capital city, whether the village is located in an urban area, current and historical distance to the coast[14], the historical exposure to the trans-Atlantic and Indian slave trades, the precolonial population density (in 1700), and the population density in 2005.

At the ethnicity-level (vector of ethnicity-level controls $\mathbf{Z}_\mathbf{e}'$), we control for the malaria ecology of the land, average elevation, and the share of land within 10 km of water.

The three vectors of individual-, village- and ethnicity-level controls ($\mathbf{X}_\mathbf{i}'$, $\mathbf{Y}_\mathbf{j}'$ and $\mathbf{Z}_\mathbf{e}'$) plus the country fixed effects constitute the baseline set of controls.

2.4.2 OLS Estimation

2.4.2.1 Baseline Results

Table 2.5a presents OLS estimates of the impact of the proximity to a mission with a printing press on newspaper readership. In all the specifications we include the baseline controls. Column 1 shows that a 1% increase in the proximity to the closest mission with a printing press is associated with an increase in the probability of reading a newspaper by nearly 1.4 percentage points. Controlling for the proximity to the closest mission increases slightly the point estimate to 1.5 percentage points; there is no effect of the proximity to a mission without a printing press (Column 2). This negative coefficient is statistically significant and economically meaningful. A one-standard deviation increase in the logarithm of the proximity to the printing press increases the probability of reading newspapers by 3.6% of a standard deviation (Column 2). In the following tables we include the proximity to a mission without a printing press in our baseline set of controls.

Reducing the sample to individuals close to a Protestant mission As shown in Section 5.3, regions near historical mission settlements have on average a higher population

[14]Historical distance to the coast is the distance to the coast of the respondent's ethnicity.

density and better geographic conditions than regions further. Moreover, all the mission stations invested in activities, especially education, that are probably correlated with long-term development. Therefore, we restrict our sample of analysis to regions near historical mission settlements. Such restrictions aim at correcting for possible selection in mission location. The rest of the analysis is conducted *within* regions near missions.

In Columns 3 to 5 of Table 2.5a we present the results of the estimation of equation (2.1) when the sample is restricted to individuals near a Protestant mission. Near is sequentially defined as being in a village with at least a Protestant mission in a 200 km (Column 3), 150 km (Column 4), and 100 km (Column 5) radius around the village. These restrictions represent, respectively, 80%, 70% and 60% of the sample.

For all the different specifications, we find a negative and statistically significant impact of an increase in the proximity to a printing press. The point estimates vary between 1.3 and 1.5 percentage points. Considering individuals living in a village with at least one mission in a 150 km radius around the village (Column 4), we find that a one-standard deviation increase in the proximity to the closest printing press increases newspaper readership by 3.1% of a standard deviation. A variance decomposition of the results shows that the proximity to the printing press and the other covariates together explain 21.3% of the total variation in newspaper readership. Of these 21.3%, 0.4 to 2.9% is explained by the distance to the printing press.

The Appendix Table B.2 reports the estimated coefficients for all the covariates. All the coefficients are of the expected sign. Table B.2, reports the standardized coefficients (beta coefficient) for all the covariates. The impact of the distance to the printing press is of the same order of magnitude as the intensity of cash constraints, the distance to the capital and smaller than the urban area dummy. The effect of the respondent's level of education is around ten times higher. This difference is not surprising since distance to the printing press captures a historical effect that might have been attenuated over time. The effect of the interaction between proximity to the printing press and education is discussed in Section 2.5.

As the sample is restricted to regions close to historical mission settlements, the effect found can be lower than the real ones if the printing press has a spillover effect across regions. If the effect of the printing press vanishes in regions outside the threshold but is present in regions considered, then our estimates might indeed be downward biased because of spatial externalities (Miguel and Kremer, 2004; Michalopoulos and Papaioannou, 2011).

2.4.3 Endogenous Selection of Missions into Printing

A crucial empirical challenge is the possibility of endogenous selection of missions into printing. Therefore, we augment regression (2.1) with an extensive set of covariates. We then develop an instrumental variable approach.

2.4.3.1 Selection on Observables

We augment our baseline set of controls with additional potential determinants of the location of the mission stations and of the missions with a printing press among mission stations. These determinants include a binary variable equal to one if any part of the railway network was built on land historically inhabited by the ethnic group and zero otherwise; a binary variable equal to one if an European explorer traveled through land historically occupied by the ethnic group; and the distance to the closest precolonial city (cities in 1400).

We also control for the distance to the closest missionary investments that may be correlated with long-term development: different types of schools (high school, boarding school, college, etc) and health facilities. Similarly, we add geographic and investment characteristics of the closest mission: the annual precipitation level, the suitability for rain-fed crops, the number of agricultural growing days and the accumulated temperature, the number of native workers, students, teachers and physicians, the total population of the mission and the arrival date of the mission. Finally, we add the logarithm of the distance to the closest Catholic mission in 1889.

Table 2.5b shows the results of the estimation of equation (2.1) when all these additional

Table 2.5: *Distance to a Printing Press and Newspaper Readership, OLS Estimation*

(a) ***Baseline Estimation***

	(1) All b/se	(2) All b/se	(3) 200km b/se	(4) 150km b/se	(5) 100 km b/se
Distance Printing Press	-0.014**	-0.015**	-0.013*	-0.015**	-0.013*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Distance Mission		0.004	0.005	0.000	0.001
		(0.005)	(0.006)	(0.006)	(0.007)
Observations	15086	15086	12405	10970	9383
Baseline Controls	Yes	Yes	Yes	Yes	Yes
Clusters	1809	1809	1456	1315	1136
R2	0.360	0.360	0.357	0.353	0.357
F-Statistic	205.5	201.6	185.4	174.9	158.3

(b) ***Estimation with Additional Controls***

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.018**	-0.023***	-0.021**
	(0.009)	(0.009)	(0.009)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.359	0.356	0.361
F-Statistic	137.6	130.2	120.0

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village-, and ethnicity-level controls described in the text. All specifications include country fixed effects. In columns 1 and 2 we present results for the entire sample. In columns 3 to 5 the sample is sequentially restricted to individuals living 200 km (column 3), 150 km (column 4) and 100 km (column 5) away from a historical mission settlement.

controls are added. Our results are robust to the inclusion of these controls and they are more statistically significant. Moreover the magnitude of the effect is larger. The point estimates vary from 1.8 to 2.3. A one-standard deviation increase in the proximity to the closest printing press increases newspaper readership by 5.2% of a standard deviation when considering the 100 km threshold (Column 3).[15]

2.4.3.2 IV Estimation

Despite our attempts to control for observable factors, our estimates might be driven by unobserved factors correlated both with long-term development and proximity to historical location of a mission with a printing press. We thus develop an instrumental variable approach. This approach is based on our historical readings of the different preferences of missionary societies for the printing press.[16]

In the early period of missionary expansion, missionaries faced numerous difficulties despite the support of an increasing number of church ministers (Ellis, 1844). Travels were often costly and required careful planning. Moreover, independent missionaries could face the hostility of colonial powers, especially fearing anti-slavery positions. In the late 18th Century, they also endured the hostitility of the clergymen who disagreed with the conversion methods used by the evangelists.

As a result of the raising popularity of the missionary work and the struggles missionaries faced, different associations of missionaries and evangelists started to emerge in the late 18th Century. The first societies were mostly launched under the impulsion of the evangelists, for instance the Baptist Missionary Society (BMS) founded in 1792 by William Carey. Many of them had no denominational affiliation and emerged as the association of

[15]In the Appendix Table B.18 we report the coefficients for all the different distances. Only distance to the printing press matters for newspaper readership nowadays

[16]Bai and Kung (2011), in their study of protestantism and economic prosperity in China, similarly compare the effects different Protestant denominations had on economic outcome, different denominations emphasizing Calvinist principles differently. We improve this empirical strategy in two important ways. First, while Bai and Kung (2011) work at the denomination level, we work at the society level (see more on this below). Second and most importantly, we are able to measure the exact investments made by each society.

churchmen convinced of the importance of the missionary work. In 1795, several meetings between different churchmen (among which John Love, John Townsend, John Eyre and George Townsend) established the founding principles of the London Missionary Society (LMS). These principles reflect the will to overcome denominational barriers and join efforts for the purpose of missionary work. This will is clear in the founding letter of the LMS signed in 1795:

> "We [...] declare our earnest desire to [...] unite together, purposing to use our best endeavors that we may bring forward the formation of an extensive and regularly organized society, to consist of evangelical ministers and lay brethren of all denominations, the object of which society shall be, to concert and pursue the most effectual measures for accomplishing this important and glorious design." (Ellis, 1844, p.19).

In the early 19th Century, numerous and diverse societies had been created. The Church Missionary Society (CMS), for instance, was founded in 1800 by the Church of England in response to the raising popularity of the missionary work (Stock, 1899). The aim of these organizations was to coordinate efforts and funds of the missionary work. Their priorities differed and depended on the preferences and means of the societies' command. The CMS, for instance, *"in the absence of missionaries,[...] fell back upon the printing press as an agent of evangelization"* from the start of its activity (Stock, 1899, p.75). Similarly, *The Duff*, the first vessel sent abroad by the LMS to Tahiti, carried *"a valuable collection of articles of clothing, books, printing apparatus, and useful tools"* (Ellis, 1844, p.40). On the contrary, the Christian Missionary Alliance, founded in 1887 by the wealthy Reverend Albert B. Simpson, had not invested in a single printing press ten years later, even though it had already settled 52 missions around the globe (Dennis *et al.*, 1903).

IV strategy There are 5,535 missions in the entire world outside sub-Saharan Africa (6,258 including sub-Saharan Africa) reported in the *Geography and Atlas of Christian Missions*. Only 2.3% of these missions had a printing press.[17] These missions were affiliated with 262

[17] This is slightly lower than in sub-Saharan Africa where the percentage of the missions with a printing press was 3.7%.

different societies among which 69 are present in both sub-Saharan Africa and the rest of the world. Moreover, the arrival date of missions with a printing press to Africa and to the rest of the world is almost identical (1877 for both samples).

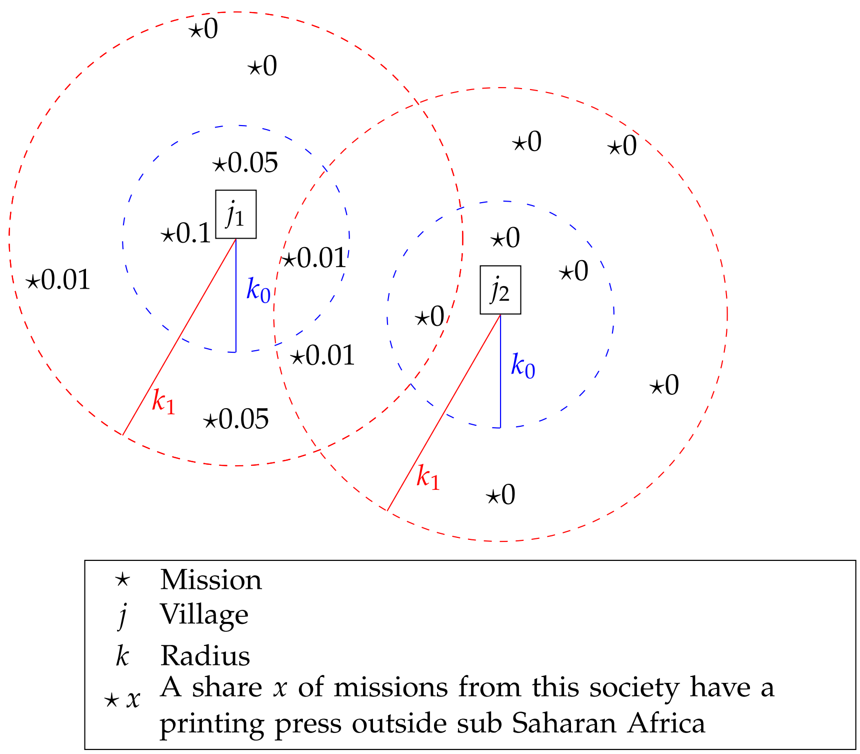
Let “Society PP_m" be the share of missions from mission m's society equipped with (at least) a printing press in all the regions of the world *outside sub-Saharan Africa*. In sub-Saharan Africa, we know the originating society for 679 out of our 723 missions (44 missions were either affiliated to a society existing only in sub-Saharan Africa or not affiliated to a society). Among the 69 originating societies recorded, 16.8% had a printing press in at least one of their missions. Our instrumenting assumption is that the larger this share, the more likely it was for a mission associated with this society to invest in a printing press in sub-Saharan Africa. In the Appendix Table B.9 we find a statistically significant and positive correlation of “Society PP” with the probability that a mission has a printing press.

Let “Village $\text{Printing}_j(k)$" be the sum of Society PP_m for all the missions historically located less than k km away from village j. For each village j, we call $m_j(x)$ any mission station historically located x km away from j. The variable “Village $\text{Printing}_j(k)$" is defined in equation (2.2):

$$\text{Village Printing}_j(k) = \sum_{x \leq k} \text{Society PP}_{m(x)} \tag{2.2}$$

Figure 2.3 represents the construction of the instrumental variable. Take the example of two different villages j_1 and j_2 and two different distances given by the radii k_0 and k_1. If we consider the smaller radius k_0 then village j_1 has a higher probability – as estimated by Village $\text{Printing}_{j_1}(k_0)$ – to be closer to a mission with a printing press than village j_2. By construction, the larger the radius, the higher the potential value of Village $\text{Printing}_j(k)$.

“Village $\text{Printing}_j(k)$" is used as an instrument for “Distance Printing Press". The exclusion restriction is that the share of missions from a society having invested in a printing press outside sub-Saharan Africa (“Society PP_m") is not correlated with long-term determinants of newspaper readership in sub-Saharan Africa. For instance, societies that invested the most in printing presses should not be the richest, nor have invested more, nor be located



Notes: Figure 2.3 provides an illustrative example of how we construct the "Village Printing$_j(k)$" variable. In the Figure, we consider the case of two different villages – j_1 and j_2 – and of two different distances given by the radius k_0 and k_1.

Village Printing$_{j_1}(k_0) \; = \; 0.16 = 0.1 + 0.05 + 0.01.$

Village Printing$_{j_1}(k_1) \; = \; 0.23 = 0.05 + 0.1 + 0.01 + 0.01 + 0.01 + 0.05.$

Village Printing$_{j_2}(k_0) = 0.$

Village Printing$_{j_2}(k_1) = 0.02 = 0.01 + 0.01.$

Figure 2.3: *Instrumenting the Distance to the Printing Press Using Missions' Society: A Graphical Illustration*

in places with the best geographic characteristics. We provide evidence supporting the exclusion restriction in Table 2.6 and Appendix Tables B.7. Table 2.6 compares the average investments of missionary societies outside sub-Saharan Africa depending on whether they invested in the printing press. There is no significant difference other than the arrival date. In 1903, societies that had invested in the printing press had settled, on average, earlier than those that did not. Similarly, Table B.7 in the Appendix reports OLS estimates of the mission-level regression of "Society PP" on mission characteristics, investments, geographic and historical characteristics. None of the coefficients are statistically significant. Societies that invested the more in printing outside sub-Saharan Africa did not systematically conduct other type of investments in sub-Saharan Africa, nor did they settle in more geographically favored regions.

Results Table 2.7 presents the results using a 50 km radius for the construction of "Village Printing (k)".[18] Table 2.7 Panel A gives the results of the first stage of the estimation. All the coefficients are negative and statistically significant. A one-standard deviation increase in "Village Printing$_j(50)$" decreases the distance to the closest printing press by 5.7% of a standard deviation for regions located less than 150 km away from a historical mission settlement (Column 2).

Table 2.7 Panel B presents the results of the second stage of the estimation. The positive impact of the proximity to a printing press on newspaper readership is robust to the instrumentation strategy. If anything, the results tend to be larger than those obtained in the previous sections. A one-standard deviation increase in the distance to the closest printing press decreases individual newspaper readership nowadays by 10% of a standard deviation for regions located less than 150 km away from a historical mission settlement (Column 2). Results for regions located less than 200 km or 100 km away from a historical mission settlement are of similar magnitude.

The magnitude of the IV coefficients is larger than the OLS's. The OLS estimates might

[18] In the Appendix Tables B.10 and B.11, we show that the results are robust to the use of other radii.

Table 2.6: *Investments of Societies With and Without a Printing Press*

	No Printing	Printing	Diff/se
Mission Characteristics			
Arrival Date	1867	1842	25**
			(8)
Bible Society	0.10	0.09	0.01
			(0.06)
Number of Native Workers	1.38	1.42	-0.04
			(1.43)
Total Population	220	172	48
			(61)
Investment in Education			
Schools (any kind) in mission	0.37	0.51	-0.14
			(0.11)
Number of Students	215	166	49
			(61)
Schools per Student (%)	0.54	0.66	-0.12
			(0.24)
Teachers per Student (%)	9.87	11.07	-1.19
			(3.42)
Other Investments			
Health Facilities	0.26	0.46	-0.20
			(0.16)
Physicians per Capita (%)	0.56	0.19	0.37
			(0.59)
Health Facilities per Capita (%)	2.22	0.91	1.30
			(1.49)
Observations	69		

Notes: The table compares average investments performed by societies in the entire world depending on whether they invested in the printing press somewhere in the world before 1903. Societies compared are those also present in sub-Saharan Africa.

Table 2.7: *Impact of the Proximity to a Printing Press, IV Estimation*

	(1)	(2)	(3)
	200km	150km	100km
Panel A: Dependent Variable is Distance Printing Press			
Village Printing (50)	-0.549**	-0.524**	-0.412**
	(0.174)	(0.192)	(0.200)
Panel B: Dependent Variable is News Readership			
Distance Printing Press	-0.045**	-0.040**	-0.042*
	(0.019)	(0.019)	(0.022)
Observations	11925	10583	9059
Baseline Controls	Yes	Yes	Yes
Clusters	1401	1267	1093
R2 First Stage	0.638	0.635	0.632
F First Stage	58.734	61.653	59.942

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The unit of observation is an individual. Standard errors in parentheses are clustered by village. The table reports the first and second stage of the IV estimation of the impact of the distance to a printing press on newspaper readership. The distance to a printing press is instrumented by Village $\text{Printing}_j(50)$. The construction of the variables "Village $\text{Printing}_j(50)$" and "Denomination PP_m" is described in more details in the text. The controls are the individual-, village-, ethnicity- and mission-level controls described in the text.

be suffering from attenuation bias due to measurement error in mission locations. This measurement error might come from the "manual" construction of the dataset or errors in placement from the historical maps. It might make it more difficult to gauge the effect of the proximity to a mission with a printing press in the OLS estimation. The instrumentation would then be correcting for the attenuation bias, hence increasing the point estimates.

Taken together, all the results from Section 2.4 are consistent with the idea that the introduction of the printing press has a long-lasting effect on newspaper readership.

2.4.3.3 Robustness Checks

We perform several robustness checks. This section briefly describes them; the detailed results for these tests are in the Appendix.

In the Appendix Section B.3.1, we check that the results of Table 2.5b are robust to using a matching strategy. As opposed to the OLS estimator that imposes linearity in the parameters, the matching estimator allows for non-linear effects of observables (Acemoglu, 2005). Our results robust to using matching (Table B.17).

Moreover, in the Appendix Section B.3.2, we use insights from Altonji *et al.* (2005) and Oster (2013) to assess the bias from unobservables using the sensitivity of the treatment to added controls under the proportional selection assumption. The resultsmake it unlikely that the entire estimated effect of the distance to the printing press is driven by unobserved variables.

Some of the contemporary controls, especially education, may be *bad controls* in the sense of Angrist and Pischke (2009). This issue would arise if any of the contemporary controls were also outcomes. Appendix Table B.20 presents the results of the estimation of equation (2.1) with the additional observables added in Table 2.5b but without education, religion, cash constraints, water constraints, population density in 2005, distance to the capital, watching the news on television and listening to the news on the radio in the controls set. The results are not significantly different from those presented in Table 2.5b.

Because missions that invested in the printing press might be larger, we also check that our effect is not driven by the mission size. As a falsification test, we estimate equation (2.1) with the distance to the 30 largest missions as the main explanatory variable.[19] The results are given in the Appendix Table B.21. Distance to the largest missions has no effect on newspaper readership nowadays.

Appendix Table B.23 shows the results of the estimation of equation (2.1) for a sample restricted to former British colonies. Our results are robust to this restriction and the magnitude of the effect remains unchanged. Our results thus cannot be entirely attributed to the colonizer's legal origins.

We also estimate equation (2.1) using two-way clustering at the closest mission and the

[19] The size of the mission is the total number of students, missionaries and indigenous teachers and workers. Within these 30 largest mission, only two have a printing press.

village levels. Clustering the standard errors at the mission level might be relevant should the closest mission be also considered as a treatment. Table B.22 shows that our results are robust to this two-way clustering strategy. Our results are also robust to a Probit rather than an OLS specification (Appendix Table B.19).

Finally, Appendix Table B.24 presents the results of the estimation of equation (2.1) when the dependent variable $News_{ijc}$ is a binary variable equal to one if individual i in village j and country c listens to the news on the radio (Columns 1 to 3) or watches the news on television (Columns 4 to 6) at least once a month. We find no statistically significant effect of the printing press on listening to the news on the radio or watching them on television.

2.5 Discussion

Is newspaper readership today really measuring regional persistence in newspaper reading habits? Or are our results driven by an increase in education in regions close to the printing press, even *within* regions close to missions? This section first explores the possible channels explaining the effect of the printing press on newspaper readership. It then investigates the relationship between proximity to a printing press and political participation. Finally, it documents the long-term consequences of the printing press on economic development and studies the channels explaining this relationship.

2.5.1 Printing Press and Newspaper Readership: Channels of Transmission

Education As one of the missionaries' objectives was to maximize conversion through reading the Bible, they taught literacy to the native population (Woodberry, 2004).[20] A number of recent studies emphasize the positive consequences on human capital of conversion through reading the Bible (Becker and Woessmann, 2009; Bai and Kung, 2011; McCleary and Pesina, 2012; Woodberry, 2012). In the sub-Saharan African context, Nunn (2009b) finds that Protestant missions increased educational attainment (see also Nunn and Wantchekon,

[20] The role of missionary activity on literacy was significantly reduced later in the Century (around the 1940s) when imaging technology developed (McCleary and Pesina, 2012).

2011). Human capital accumulation, fostered by missionary activity, might thus be driving our results. We show in this section that it is not the case.

Two aspects of our econometric analysis account for the effect of education on newspaper readership, independently of proximity to the printing press. First, education is included in our baseline set of controls. Second, we control for the number of teachers and the number of students in the nearest mission and the distance to the nearest mission with a school or a high school. These controls capture the historical regional determinants of education. Moreover, as a falsification test, we estimate the impact of the proximity to a printing press on education. Table 2.8 shows no statistically significant effect of the distance to a printing press on education.

This result does not imply that missionaries had no long-term impact on education and human capital accumulation. Consistently with the existing literature (Wantchekon *et al.*, 2012), we find a positive and statistically significant impact of the proximity to a mission with a high-school on education (Table 2.8). For regions located less than 150 km away from a mission, a one-standard deviation increase in the distance to the closest mission with a high school increases education today by 6.9% of a standard deviation. Moreover, distance to the printing press can only affect newspaper readership if people are educated enough to read the news. In Table 2.9a, we interact the distance to the printing press with a binary variable equal to one if the education level of the individual is above the median (equivalent to having completed elementary schooling). As expected, proximity to a printing press only affects newspaper readership when education is high enough.

Publication records Is newspaper readership today really capturing the regional historical development of the newspaper and printing industry? To answer this question, we use a proxy for the regional development of the publishing industry; we gather information on the number of publications printed at the mission press until 1923. In the publication record data, we find that 18 missions with a printing press (out of the 27 missions equipped with a printing press in 1903) had a publication record in 1923. The missions where these printing presses were located did not exhibit any particular type of geographical or historical

Table 2.8: *Proximity to a Printing Press and Education, Controlling for Observables*

	Education		
	(1)	(2)	(3)
	200km	150 km	100 km
	b/se	b/se	b/se
Distance Printing Press	-0.024	-0.032	-0.034
	(0.028)	(0.028)	(0.029)
Distance Any Schools	-0.018	-0.019	-0.018
	(0.050)	(0.049)	(0.051)
Distance High/Boarding School	-0.084*	-0.092*	-0.092*
	(0.050)	(0.049)	(0.050)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.381	0.396	0.389
F-Statistic	127.4	119.6	102.5

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. Standard errors in parentheses are clustered by village. The controls are the individual-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the level of education nowadays. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 2) and 100 km (Column 3) away from a historical mission settlement.

characteristics nor did they specialise in any kind of specific investments (online Appendix Tables B.3 and B.4). We therefore interpret the presence of such records as a proxy for the activity of the printing presses: printing presses with a publication record in 1923 were probably the most active. Table 2.9b shows the result of regression (2.1) when we add distance to the closest mission with a publication record ("Distance PP with Publication") as a control. The coefficient associated with "Distance PP with Publication" is negative and statistically significant. Moreover, once we control for the distance to a mission with a printing press and a publication record, the coefficient associated with the distance to a printing press is no longer statistically significant. This suggests that the impact of the distance to a printing press on newspaper readership may be explained by the development of publishing activities.

The results of Table 2.9b have to be taken carefully since they rely heavily on the only archival source we found to track the middle-run evolution of the publishing activities of missions with a printing press. However, they are in line with our assumption that the long-term impact of the printing press on newspaper readership may be due to the early development of the newspaper industry around missions with a printing press.

2.5.2 Political Participation

The literature on the determinants of political participation in sub-Saharan Africa has mainly focused on the role of ethnicity (Gibson and Long, 2012; Ichino and Nathan, 2013a) and clientelism (Ichino and Nathan, 2013b). We contend that media access – through proximity to a printing press – might be another important determinant of political participation. Information may indeed affect political outcomes (DellaVigna and Kaplan, 2007; Enikolopov *et al.*, 2011) and participation at elections (Stromberg, 2004; Oberholzer-Gee and Waldfogel, 2009; Gentzkow *et al.*, 2012).[21]

We estimate the impact of the distance to a printing press on three different measures of

[21] With the notable exception of Reinikka and Svensson (2005), there has been very little quantitative work in economics on mass media focusing on Africa although Africa is an exemplary place to study newspaper activity.

Table 2.9: *Proximity to a Printing Press and Newspaper Readership, Interactions*

(a) ***Baseline Estimation***

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.009	-0.011	-0.008
	(0.010)	(0.010)	(0.010)
1{High Education} x Distance PP	-0.016*	-0.023***	-0.025***
	(0.008)	(0.008)	(0.008)
1{High Education}	0.167***	0.200***	0.205***
	(0.047)	(0.045)	(0.047)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.362	0.359	0.364
F-Statistic	142.6	134.2	123.6

(b) ***Interaction with Publication Records***

	(1) 200km b/se	(2) 200km b/se	(3) 150km b/se	(4) 100km b/se
Distance Printing Press		0.011	0.010	0.012
		(0.023)	(0.023)	(0.023)
Distance PP with Publication	-0.047***	-0.060**	-0.060**	-0.055*
	(0.013)	(0.029)	(0.029)	(0.031)
Observations	9195	9195	7992	6782
Baseline Controls	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes
Clusters	1043	1043	927	795
R2	0.360	0.360	0.356	0.360
F-Statistic	97.77	97.07	92.37	87.27

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is an individual. Standard errors in parentheses are clustered by village. The controls are the individual-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the level of education nowadays. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 2) and 100 km (Column 3) away from a historical mission settlement.

political participation[22]: registration for elections[23]; voting in past elections[24]; and a proxy for political participation at the local level ("Actions as Citizen"[25]). We also estimate its impact on a measure of satisfaction with the democratic system ("Satisfaction"[26]) as well as on a proxy for the quality of political discussion at the local level ("Listen"[27]).

Proximity to the printing press might have affected political participation through newspaper readership. However, the historical dynamics associated with the arrival of the printing press might also affect directly political participation. For instance, the introduction of the printing press may have increased nationalism through the strengthening of a common language (Anderson, 1991).[28] Moreover, newspaper readership may have increased political participation, but the latter may also exhibit a persistent pattern.

Results We aim at determining whether there is a relationship between distance to a printing press and political participation and, if so, the extent to which this relationship is captured by contemporary newspaper readership or if, on the contrary, the historical

[22]Each variable is described in a subsequent footnote. The description provides the question used in the Afrobarometer to construct the variable. The variables are summarized in the online Appendix Table B.1.

[23]Understanding that some [Ghanaians/Kenyans/etc.] were not able to register as voters for the [20xx] elections, which statement is true for you? You were registered to vote, You did not want to register, You could not find a place to register, You were prevented from registering, You were too young to register, Did not register for some other reason, Don't Know/Can't remember.

[24]With regard to the most recent, [20xx] national elections, which statement is true for you? You voted in the elections, You decided not to vote, You could not find the polling station, You were prevented from voting, You did not have time to vote, Did not vote for some other reason, You were not registered, Don't Know/Can't remember.

[25]Here is a list of actions that people sometimes take as citizens. For each of these, please tell me whether you, personally, have done any of these things during the past year. If not, would you do this if you had the chance: attend a community meeting; go together with others to raise an issue; attend a demonstration or protest march.

[26]Binary variable indicating that an individual both thinks that his country is a democracy and is "fairly" or "very satisfied" with "the way democracy works".

[27]Binary variable indicating whether respondent disagreed with the statement: "As far as politics is concerned, friends and neighbors do not listen to you?"

[28]*"If we consider the character of these newer nationalisms which, between 1820 and 1920, changed the face of the Old World, two striking features mark them off from their ancestors. First, in almost all of them "national print-languages" were of central ideological and political importance."* (p.67) Similarly, Eisenstein (1980) argues that *"it is not accident that nationalism and mass literacy have developed together. The two processes have been linked ever since Europeans ceased to speak the same language when citing their Scriptures or saying their prayers"* (p.165).

dynamics associated with the printing press have a persistent effect on political participation per se.

Following equation (2.1), we estimate the following equation:

$$\begin{aligned}\text{Civic}_{ijec} = &\alpha_1 \text{ Read News}_i + \alpha_2 \text{ Distance Printing Press}_j \\ &+\alpha_3 \text{ Distance Printing Press}_j \times \text{Read News}_i \\ &+\beta_1 \text{Distance Mission}_j + \boldsymbol{X_i'\beta_2} + \boldsymbol{Y_j'\beta_3} + \boldsymbol{Z_e'\beta_4} + \delta_c + u_{ijec}\end{aligned} \tag{2.3}$$

where Civic_{ijec} is any of the civic attitudes outcomes defined in the previous paragraph, and Read News_i is a binary variable equal to one when the individual reads newspapers. The marginal effect of distance to the printing press among newspaper readers is $\alpha_2 + \alpha_3$.

Table 2.10 presents the results of OLS estimation. Distance to the printing press only has a negative and statistically significant effect on “Listen" and “Actions", i.e. political participation at the local level. A one-standard deviation increase in distance to the printing press decreases “Listen” by 4.3% of a standard deviation. A one-standard deviation increase in distance to the printing press decreases “Actions” by 3.5% of a standard deviation among newspaper readers and by 7.6% of a standard deviation among non readers. In other words, contrary what one could have expected, the persistent effect of the distance to a printing press on political participation is stronger among non-newspaper readers than among readers. Understanding why it is the case is beyond the purpose of this paper.

In the next sub-section, we finally investigate the long-term consequences of the introduction of the printing press on economic development.

2.5.3 Contemporary Economic Development

According to Dittmar (2011), between 1500 and 1600, European cities where printing presses were established in the 1400s grew 60% faster than otherwise similar cities . We investigate here the link between distance to the printing press and economic development in sub-Saharan Africa and discuss the potential channels explaining this relationship.

As shown in Section 4.3, Figures 2.2 and **??** suggest that there is a negative correlation

Table 2.10: *Proximity to a Printing Press and Civic Attitudes*

	(1) Register b/se	(2) Turnout b/se	(3) Action b/se	(4) Listen b/se	(5) Satisfaction b/se
Distance Printing Press	-0.001	-0.001	-0.035***	-0.020*	-0.014
	(0.007)	(0.007)	(0.009)	(0.012)	(0.010)
Distance PP x Read News	0.008	0.009	0.019**	0.004	0.003
	(0.006)	(0.007)	(0.008)	(0.010)	(0.009)
Read News	-0.046	-0.053	-0.057	0.036	-0.025
	(0.034)	(0.038)	(0.046)	(0.057)	(0.050)
Observations	12254	12297	12297	8806	10077
Baseline Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes
Clusters	1453	1454	1454	1388	1430
R2	0.228	0.206	0.156	0.0746	0.197
F-Statistic	45.85	48.79	45.28	11.22	41.02

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is the individual. The controls are the average individual (per village)-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the log of average light density in a 10km buffer around the town. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 2) and 100 km (Column 3) away from a historical mission settlement.

between distance to the printing press and economic development nowadays. Moreover, Figure 2.2 is consistent with the interpretation of distance to the printing press having generated a regional dynamic fostering economic development. There is indeed no evidence of any pre-existing gap in population density between regions close to missions with and without a printing press.

Table 2.11 shows the estimated coefficients from the regression of city-level light density on “Distance Printing Press". A one-standard deviation increase in distance to the printing press significantly decreases light density by 10.7% of a standard deviation (Column 1). This estimate is robust to instrumenting distance to the printing press using the IV strategy described in Section 2.4.3.2 (online Appendix Tables B.12, B.13, and B.14).

How to explain such a long-term effect of the printing press on economic development among regions close to missions? Weber’s hypothesis of *The Protestant Ethic* suggests that religion per se might be the driver. Such interpretation would only hold if religiosity was higher close to the printing press. However, recent studies have challenged this interpretation. Becker and Woessmann (2009) and Cantoni (2013) show in the European context that the link between protestantism and economic development is mainly due to human capital accumulation.[29] Building on Habermas (1989), Dittmar (2011) argues that proximity to the printing press has enabled the development of a culture of information exchange and of an urban, bourgeois public sphere. We argue that newspaper readership may be another channel explaining the positive relationship between proximity to a printing press and contemporary economic development. In particular, if newspaper readers are more informed citizens more likely to cross party lines when voting – Casey (2013) shows that it is indeed the case in the Sierra Leonean context[30] – then, through an increase in newspaper readership, proximity to a printing press may have increased political accountability, leading

[29]Becker and Woessmann (2009) use county-level data from late-nineteenth-century-Prussia and use distance to Wittenberg as an instrument for Protestantism. Cantoni (2013) uses population figures of 272 cities across the Holy Roman Empire in 1300-1900.

[30]Using differential radio coverage, she shows that increased information about candidate competence presents a counterpoint to tribal loyalty and strengthens accountability.

to a more equitable allocation of public spending and higher economic development.

Columns 2 to 8 of Table 2.11 examine these potential channels – religiosity, education, political participation and newspaper readership – through which the printing press may have affected economic development. For each town j, we define a set of binary variables $\mathbf{1}\{\text{High z}\}$ equal to one whenever the value of z in town j is higher than the median. The only variables capturing the effect of the distance to the printing press on economic development are newspaper readership and the share of Protestants in town j (Columns 3, 7, and 8). Protestantism affects negatively economic development nowadays, contradicting Weber's assumption. The interaction term of distance to the printing press and newspaper readership is negative and statistically significant. It is almost identical to the effect in Column 1, suggesting that the development of the media is the main channel through which the printing press has a long-term impact on economic development.

2.6 Conclusion

In this paper, we study the impact of the early introduction of the printing press by Protestant missionaries in the 19th Century. The evidence we obtain from a variety of identification strategies is consistent with our hypothesis that the early introduction of the printing press has long-term effects on newspaper readership. Moreover, we document a long-term impact on contemporary economic development. We show that the early development of the newspaper industry and reading habits can explain part of these long-term effects of the printing press on economic development in sub-Saharan Africa. Our results suggest that a better understanding of African media development will be key for the future of African democracy and economic change.

Table 2.11: *Proximity to a Printing Press and Light Density*

	(1) b/se	(2) b/se	(3) b/se	(4) b/se	(5) b/se	(6) b/se	(7) b/se	(8) b/se
Distance Printing Press	-0.292**	-0.098	-0.108	-0.173	-0.277**	-0.280**	-0.579***	-0.136
	(0.136)	(0.164)	(0.165)	(0.166)	(0.136)	(0.138)	(0.174)	(0.258)
Distance PP with Publi		-0.358**						-0.247
		(0.167)						(0.177)
Distance PP x **1**{High Read News}			-0.244*					-0.224**
			(0.130)					(0.109)
1{High Read News}			1.674**					1.544**
			(0.751)					(0.615)
Distance PP x **1**{High Education}				-0.160				-0.033
				(0.130)				(0.109)
1{High Education}				0.973				0.188
				(0.763)				(0.626)
Distance PP x **1**{High Action}					-0.041			-0.086
					(0.096)			(0.097)
1{High Action}					0.303			0.532
					(0.517)			(0.530)
Distance PP x **1**{High Listen}						-0.021		-0.051
						(0.095)		(0.090)
1{High Listen}						-0.008		0.145
						(0.520)		(0.490)
Distance PP x **1**{High Protestant Today}							0.368**	0.298*
							(0.149)	(0.168)
1{High Protestant Today}							-1.807**	-1.387
							(0.850)	(0.958)
Observations	1307	1307	1307	1307	1307	1307	1307	1307
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.612	0.615	0.616	0.613	0.612	0.613	0.616	0.622
Clusters	320	320	320	320	320	320	320	320
F-Statistic	53.93	47.39	60.41	56.92	51.89	54.34	50.37	49.44

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is the town. The controls are the average individual (per village)-, village, ethnicity- and mission-level controls described in the text. The regressions are weighted by the population size of each town

Chapter 3

Improving "National Brands": Reputation for Quality and Export Promotion Strategies[1]

3.1 Introduction

Why are consumers willing to pay more for indistinguishable "Made in Germany" than "Made in China" products? In which way is building a solid reputation for reliability and quality key to a developing country's economic success – and how can it be achieved? Conversely, can a history of exporting cheap low-quality goods be an obstacle *per se* to national development strategies aimed at upgrading quality over time? These questions find no clear answers in standard models of international trade, which assume that consumers are perfectly informed about the characteristics of every available product and leave no role for country reputations. However, as an old and large literature on experience goods has shown, starting with Nelson (1970), quality is not fully known to consumers prior to purchase for a wide range of goods. Inferring the quality of a good on offer requires time and is achieved both through search and through experience. For these categories of goods,

[1] Co-authored with Dorothée Rouzet

country-of-origin affects product evaluations and consumers' decisions. Indeed, many survey-based studies in the marketing literature, summarized by Roth and Diamantopoulos (2009), emphasize the role of country-of-origin labels in setting consumer perceptions of quality.

In this paper, we argue that a "national brand image" matters because it provides an anchor for the expected unobservable quality of imports. Consumption decisions, in practice, are based on a limited information set about the characteristics of goods or varieties. To understand the determinants of demand faced by entrants as well as incumbents in an industry, we need to consider the information available to consumers at the time of purchase: information gathered as a result of past consumption experience and word-of-mouth diffusion, but also the producer's brand name and the country where the good was manufactured. Together, these elements determine perceived quality, which affects consumption more than true quality when the latter is not observable. Specifically, for new and unknown foreign brands, the main piece of information available to consumers is the "made in" label, which indicates the country of manufacturing and creates a key role for national reputations. We call "national reputation" the common component of consumers' perceptions of the quality of goods produced within a given country. Usual examples of such priors are the widespread perceptions that "German goods last a lifetime" or " hinese goods break down quickly". Country reputations determine the quality that buyers expect from a product before they learn any information specific to this variety. In the long-run, reputations should adjust to the actual average quality of exported goods.

Using newspaper content analysis to proxy for national reputations, we provide evidence that a better reputation is associated with higher unit prices on exports to the US, after controlling for other determinants of within-sector vertical specialization across countries. Moreover, this relationship is stronger for sectors with more quality differentiation, which lends support to the asymmetric information foundation of our model.

We proceed to analyze the impact of asymmetric information on the demand for imported goods and on the long-run quality composition of a foreign country's exports. Quality uncertainty leads to consumption patterns where both brand reputation and country-of-origin matter, and where incumbents are able to charge higher prices than unknown brands. As long as quality is gradually observed through consumption, asymmetric information about quality distorts demand relatively more for new entering firms without established brand names, compared to the perfect information case. It raises profits of low-quality firms benefiting from good country-of-origin labels, but is an obstacle to exporting for high-quality firms unable to signal their type in low-reputation countries.

Broadly speaking, we are addressing three main questions. First, how does a poor "national brand" act as a barrier to entry into foreign markets? Second, under which conditions do quality expectations have self-fulfilling effects, keeping some exporting countries into low-quality traps? Finally, which policy instruments can help countries overcome the adverse impact of such information asymmetries?

More specifically, we consider a two-country model with a continuum of potential foreign exporters heterogeneous in quality and a constant flow of new entrants per period. Quality is exogenous and known to firms but not observed by consumers before purchase. Hence, import demand depends on perceived quality, which has two components. Goods imported from a given country are first evaluated according to a country-wide prior, which is determined by the average quality of the country's exports in a long-run industry equilibrium. Importers then learn about the true quality of firms that have exported in the past. The fraction of informed consumers increases with the time a firm has been active on the market. The effect of the country prior will thus prevail for new exporters and fade over time as buyers gain familiarity with individual foreign brands. On the supply side, potential foreign exporters decide whether to enter the market and when to exit, taking into account the impact of their decisions on expected future sales. If active, they sell at a price determined by the buyer's quality expectation. We assume that the cost of producing one physical unit of the good is monotonically increasing in quality, but the cost per quality-adjusted unit is decreasing in quality. Thus, although our focus is on vertical differentiation, quality and productivity are positively related in our model.

Our main channel is a distortion in entry and sales due to unobservable quality. Asymmetric information fosters entry by low-quality firms, which earn higher profits than under perfect information by free-riding on high quality expectations. It depresses profits of the highest-quality firms, forced to incur initial losses in order to reveal information about their type. At the industry level, there are two types of steady-state equilibria with endogenous country reputations. In a high-quality, high-reputation equilibrium, imperfect information does not hinder entry of high-quality firms into export markets but generates excess entry by low-quality firms. In a low-quality, low-reputation equilibrium, a range of firms with above-average quality are permanently kept out of the market by the informational friction. With costs too high to allow for positive profits in the first periods, and quality too low for initial losses to be recouped with future profits, this set of firms choose never to be active. The sorting of firms into export status is therefore non-linear: only the lowest-quality and the highest-quality firms are active. Furthermore, there can be multiple low-quality equilibria, such that countries with bad quality reputation can be locked into exporting low-quality, low-cost goods.

The model yields interesting policy implications. In particular, imperfect information about the quality of imported goods provides a justification for export promotion policies in economies specialized in low-quality products. Some export-led growth strategies for developing countries, pursued in the past by East Asian economies, rely on exporting low-quality, low-cost goods and gradually moving up to higher quality, higher unit value goods.[2] China is attempting to follow the same path. Without policy intervention, though, we show that it may not be feasible if the economy is trapped in a self-fulfilling low equilibrium, in which the country's reputation for low quality prevents high-quality firms from entering export markets. A successful export promotion policy then involves either subsidizing exporters' initial losses, or investing public resources into raising the country's perception abroad. Indeed, we find that export subsidies improve the average quality of exports, raise unit prices received by exporting firms and have a positive welfare effect in countries that

[2]We dwell in more details on the Japanese and South Korean examples in Section 3.2.

are initially in a low-quality equilibrium.[3] However, subsidies have the opposite long-run effects in countries exporting high-quality goods. In the latter case, the induced entry by low-quality firms creates a negative externality on all exporters, lowering average quality, reputation and aggregate profits.

Moreover, we show that large reputation shocks, for instance triggered by heavily mediatized events or by a government-sponsored national promotion campaign, can have self-fulfilling features. Small reputation shocks only have short-lived effects. But when there are multiple steady-states, a large positive reputation shock in a low-quality equilibrium raises prices received by all firms and allows more firms with above-average quality to enter, thereby driving up the true average quality of exported goods. Reputation and quality increase jointly until the economy settles in a higher steady-state.

This paper relates to two main strands of literature. In a closed economy framework, several early papers (Shapiro, 1983; Riordan, 1986; Farrell, 1986; Liebeskind and Rumelt, 1989) have studied entry and pricing strategies for experience goods, for which quality is unobservable a priori and is only revealed through repeated consumption. Bergemann and Välimäki (1996, 2006) incorporate the experimentation and learning processes by consumers. Furthermore, there is evidence of the benefits of a reputation for quality in terms of brand premia (Imbs *et al.*, 2010) and image spillovers across products of the same brand (Sullivan, 1990). We develop these insights further by considering the demand for imports, where initial priors depend on country-of-origin and reputations are built not only for specific firms but also for exporting countries as a whole.

In the international trade literature, vertical quality differentiation has recently been studied by Baldwin and Harrigan (2011); Johnson (2012); Verhoogen (2008); Hallak and

[3]The case for export subsidies is mixed in the existing literature. Brander and Spencer (1985) first introduced the idea of welfare-enhancing subsidies in a Cournot strategic rivalry, and Greenwald and Stiglitz (2006) developed an infant-industry argument for protective trade policy. Flam and Helpman (1987) find that the desirability of export subsidies is ambiguous, depending on the production structure. Demidova and Rodriguez-Clare (2009) show that subsidies improve productivity in a model with heterogeneous firms, but are nonetheless detrimental to welfare due to losses in terms of trade and variety. Recently, Aghion *et al.* (2012) make a more specific case for targeted industrial policy towards more competitive sectors. The main arguments for active trade policy relying on coordination failures and externalities are reviewed and assessed in Harrison and Rodrguez-Clare (2009).

Sivadasan (2009); Kugler and Verhoogen (2012); Manova and Zhang (2012) and Fajgelbaum *et al.* (2011). However, these papers assume perfectly observable quality and deal with the choice of quality by exporters. Instead, we abstract from the endogenous quality choice by firms and study the implications of asymmetric information on the equilibrium quality range of exports.

The literature most closely related to this paper deals with the policy implications of asymmetric information about the quality of foreign goods. Grossman and Horn (1988) examine the infant-industry argument in a two-period model with moral hazard in the choice of quality, and find no case for temporary or permanent protection. However, the extensive margin of trade in their model concerns only low-quality firms, while we show that a subsidization policy can also encourage entry by high-quality firms in an infinite-period setting with overlapping generations of firms. Although Bagwell and Staiger (1989) point out that asymmetric information may lead to insufficient entry by high-quality firms, they focus on a single-firm, single-consumer interaction with two quality levels and do not allow for reputation externalities between firms. We show that these externalities, from the entry decisions of heterogeneous firms to buyers' beliefs, lie at the core of the effects and of the policy implications of unobservable quality. Chisik (2003) develops the idea of a "reputational comparative advantage" whereby country labels act as a coordinating device for exporters, but also assumes away within-country reputation externalities by building a single-firm model. Lastly, Dasgupta and Mondria (2012) develop a two-period model with similar features to ours, where the quality of new exporters is unobservable and that of continuing exporters is known by a fraction of consumers. However, their paper deals with firm reputations and the role of intermediaries in providing quality assurance, taking as given the first-period price. We take the analysis further by endogenizing country reputations in an infinite-horizon setting and characterizing steady-state equilibria.

Other papers introducing imperfect information in trade have addressed different issues such as uncertainty about demand conditions for firms entering a foreign market (Hoff, 1997; Segura-Cayuela and Vilarrubia, 2008), reputation-building for distributors in the importing country (Araujo and Ornelas, 2007), or marketing costs incurred to make consumers aware of the existence of foreign goods (Arkolakis, 2010). Rauch and Watson (2003) focus on the tendency of buyers in developed countries to start small in building partnerships with suppliers in less developed countries, in order to learn about their ability to fill large orders. Finally, there are some empirical studies of the effect of perceptions of foreign countries on trade flows. Guiso *et al.* (2009) and Disdier and Mayer (2007) find a relationship between bilateral trust or bilateral opinions and imports, but do not consider the quality aspect of countries' reputations. Specific reputation shocks have only been analyzed through event studies, such as the negative perception of France in the US at the onset of the Iraq war (Michaels and Zhi, 2010) and recalls of Chinese toys (Freedman *et al.*, 2009).

The remainder of this paper proceeds as follows. Section 3.2 presents motivating historical evidence and stylized facts on the importance of national quality reputation for exporters. Section 3.3 lays out our modelling framework and Section 3.4 analyzes high-quality and low-quality steady-state equilibria with endogenous reputation. Section 3.5 explores the effects of export promotion policies on quality, reputation and profits. Finally, Section 3.6 concludes.

3.2 Empirical Motivation

3.2.1 Historical Motivation: Creating "National Brands"

Since their creation, country-of-origin labels have been related to protectionist concerns. When the "Made in Germany" label – now an internationally recognized signal of quality – was introduced, it was as a policy instrument against German exports. The label was originally created in the United Kingdom by the Merchandise Marks Act of 1887 to signal foreign products, then considered by the British society as inferior to domestic ones. Ironically, a few years later, in 1894, a commission of the German Reichstag reported that German manufacturers found the label to be of good use: having achieved superior quality, they were better able to distinguish themselves from British manufacturers. Even more surprinsingly, as reported by Umbach (2003), *"English manufacturers even began to forge the label, printing it on their English-made products"*. The "Made in Germany" label had turned from a signal of poor quality into a signal of the best quality.

Similarly, at the end of World War II, "Made in Japan" goods had a reputation for being cheap low-quality goods. Japanese companies were suffering from an inferior "national brand". On the contrary, currently, Japanese cars and electronics are ranked among the most reliable in all consumer surveys. More generally, Japan's pattern of specialization in manufactures has evolved dramatically, shifting from unskilled labor-intensive goods to human capital and R&D-intensive products (Balassa and Noland, 1989). Japanese companies achieved such a dramatic change by privately imposing strict quality norms. They formed export cartels which provided product quality guarantees, by setting product design and quality standards, establishing industry brand names, guaranteeing delivery schedules and mediating disputes between individual exporters and foreign buyers (Dyck, 1992). Providing product quality assurances to importers stimulated growth in exports and improved terms of trade. Hence, as argued by Lynn and McKeown (1988), the ability to establish collectively a reputation for product quality was key to Japan's export success. This ability was the outcome of both private companies and government initiatives: in the public policy realm, not only did antitrust laws permit the formation of export cartels, but export restrictions were exercised under the Control Law[4].

Government initiatives also played a key role in the shift in South Korea's pattern of trade specialization since the 1970s. Public investment subsidies were tied to exporting activity, as Korean governments were determined to favor the emergence of the country on the international trade scene.[5] These policies resulted in the channeling of credit at negative interest rates to South Korean conglomerates and provided them with insurance

[4]The first paragraph of Article 48 of this law sets that "*any person desiring to export goods of any designated type, or goods destined for any special areas, or to export goods by means of any designated form of transaction or payment, may be required to obtain the approval of the Ministry of International Trade and Industry*" (Matsushita, 1979).

[5]Pack and Westphal (1986), Westphal (1990), Levy (1991), and Rodrik (1995) have documented the importance of government investment subsidies in Korea.

against business risk, particularly in the export market (Aw *et al.*, 1998). This export-led development strategy is often pointed as having been the hallmark of the East Asian miracle growth (e.g. World Bank, 1993). Incidentally, Korea's determination to play a growing international role was showcased by hosting the Olympic Games in Seoul in 1988.[6] From a historical point of view, the 1988 Olympics symbolized the success of over three decades of active government intervention in the economy.[7]

In a similar way, the 2008 Beijing Olympics reaped a huge prestige bonanza for China, being (again) the most-viewed televised event ever – in the United States, the cumulative audience amounted to over two-thirds of the population – and representing China's grand entrance onto the world stage. However, an interesting takeout of this example is also its limitations. China is struggling to move up the value chain in its exports.[8] Although a large-scale national promotion event can help improve a country's image abroad, it is far from sufficient to overcome a bad reputation when the economy seems stuck in a low-quality trap, whereby high-quality firms suffer from the country's reputation in their attempts to export. The strategy of Lenovo, the only Chinese company to get a worldwide sponsorship for the 2008 Beijing Olympics, is revealing in this respect. With a Western-sounding name, the legacy of the I.B.M. brand name and technology, and a chief executive who hails from Dell and NCR, the Lenovo Group is not a company that most Americans would assume is Chinese. This is exactly what the company aims for (although Lenovo's largest shareholder is the Chinese government), aware of the fact that the typical American consumer associates Chinese products with cheap and unreliable: "*They want to be viewed as a global company,*

[6]On a related note, Rose and mark M. Spiegel (2011) show that hosting the Olympics boosts a country's subsequent exports and find support for the hypothesis that hosting mega-events (or applying to do so) serves as a policy signal.

[7]On September 17, 1988, over a billion people worldwide watched the Olympics opening ceremony, telecast from Seoul, the then largest television audience in history (Larson and Park, 1993) and a global advertisement for the country's image. South Korea "*emerged from the Games in triumph both as host and competitor. (...) [It] has been bent on showing the world that it is no longer a place to overlook. The Games are only part of that"* (*New York Times*, 10/08/1988).

[8]Schott (2008) documents that the prices that US consumers are willing to pay for Chinese exports are substantially lower than the prices they are willing to pay for OECD exports in the same product category. Furthermore, the gap or "OECD brand premium" has been increasing over time.

not a Chinese company, in the West or they'll never be able to beat the cheap rap"(*New York Times*, 06/20/08). In some sectors, Chinese firms are even relocating factories or assembly lines in Europe to obtain the "made in Europe" label, as in the plan for a "Châteauroux Business District" in France.[9] Hence, whether China can, in the coming years or decades, successfully follow the same path as Japan and South Korea in the past, remains an open question.

3.2.2 Stylized Facts: National Reputations and Unit Prices

Moving beyond anecdotal motivations, we provide some additional evidence of the importance of country-of-origin reputations in current trade patterns. This section shows that the quality of a country's exports, as measured by unit prices, is not only determined by observable fundamentals such as the country's income level and factor endowments. Perceptions, mediated by news sources, also seem to play a role – either because the media are a supplier of information beyond observable country characteristics or because of a pure reputation effect. Both of these interpretations are associated with asymmetric information in the demand for imports, which is the foundation of our model.

More specifically, news coverage of a country provides a proxy for national reputations. For consumers, the media are providers of information about safety scandals or successful businesses in foreign countries, work practices and the general reliability of foreign goods. For firms sourcing inputs from foreign suppliers, news also reflect information relevant to risks of delays, disruption of supply chains or corruption practices, which affect their expected value from the importer-exporter relationship. Our working hypothesis is that media coverage is a channel through which country perceptions are formed, confirmed or changed, affecting the demand for goods produced in countries that receive massive positive or negative news coverage.[10] We establish that controlling for the determinants of unit

[9] "Un 'made in France' très convoité", *L'Express*, 01/11/2012.

[10] This empirical approach is inspired by the literature on media bias. The broad insight from this growing literature is that media coverage affects real outcomes, such as political participation (Della Vigna and Kaplan, 2007), political accountability (Besley and Burgess, 2002), or stock market reactions to earnings announcements (Dyck and Zingales, 2003).

values and specialization into higher-quality goods that have already been identified in the literature, better reputation is associated with higher unit prices on exports. This relationship does not need to be interpreted causally but rather as an equilibrium outcome under asymmetric information: in our model, the relationship between the national reputations of exporting countries and the quality of their exports runs both ways to generate a price-reputation dependence.

3.2.2.1 Data

We collect news coverage data from the Factiva website, which aggregates content from over 31,000 news sources. We developed a script that searches all US news and business publications for articles covering a given foreign country, in a given year, and including a keyword from a list of relevant terms.[11] We gather data on 146 countries over 1988-2006, excluding countries of less than 1 million inhabitants, which receive almost no coverage in US media. The list of 116 keywords was identified through a systematic listing of recurring terms and phrases in the coverage of foreign countries and companies in the *New York Times*, the *Wall Street Journal*, *Business Week* and the *Boston Globe*. We sort them into four categories. The "political" category relates to the foreign country's general political context and is split between positive terms (e.g. "democratic transition") and negative terms (e.g. "corruption"). The "quality" category deals specifically with quality issues, improvements or scandals. We distinguish between positive (e.g. "quality control") and negative (e.g. "class-action suit") terms.[12] To avoid misclassifying negative articles as positive and vice versa, we exclude articles where a negating word appears around the keyword. For quality-related keywords,

[11] Or any word sharing the root of the keyword. For instance for the keyword "counterfeit", the script also searches for "counterfeited", "counterfeiting", etc.

[12] Examples of search results on China are: "*World briefs - Houston Chronicle, 31 December 1996, 486 words, (English)... BEIJING – China is preparing this week to carry out a series of legal reforms hailed by some as a step toward greater* rule of law *and protection of individual rights. ...*"(political, positive); "*Brilliance China Automotive Holdings Limited Announcement - PR Newswire, 5:16 AM, 31 December 2003, 3733 words, (English) ...relationship with the JinBei group of companies and will be in a better position to monitor and exercise more stringent* quality control *over the automotive components that it purchases from the JinBei group of companies. Accordingly, the Directors consider...*" (quality, positive).

we conduct the searches both at the aggregate country level and in articles dealing with specific industries for 11 sectors[13].

We obtain a total of over 2.5 billion relevant articles published in US news sources. We count the number of articles with positive or negative keywords per country-year for political and quality categories, and per country-year-industry for quality categories. We define current news variables with the number of articles in each category in the current year. Article counts are then normalized by the sum of all articles in the same category and same period across countries. The normalization accounts for the positive trend in the number of articles in the database over time.

Specifically, for country c, industry i, year t and $k \in \{\text{positive, negative}\}$, we construct the following variables:

$$\begin{aligned} \textit{industry quality news}_{c,t,i,k} &= \frac{\#\ \textit{quality articles}_{c,t,i,k}}{\sum_{c \in C} \#\ \textit{quality articles}_{c,t,i,k}} && (3.1) \\ \textit{political news}_{c,t,k} &= \frac{\#\ \textit{political articles}_{c,t,k}}{\sum_{c \in C} \#\ \textit{political articles}_{c,t,k}} && (3.2) \end{aligned}$$

We match the news data with US import data at the 5-digit SITC level from Robert Feenstra, described in Feenstra *et al.* (2002). We calculate f.o.b. unit values at the 10-digit HS level where quantity units are homogeneous across observations. We then construct sectoral indices of export unit values for each country c by calculating the average, across all 10-digit products exported in the 5-digit sector, of c's unit prices relative to those of all countries exporting the product to the United States.

Our independent variables include gravity variables from Head *et al.* (2010)[14] and international and civil conflict variables from the Correlates of War database. The correlation of votes at the United Nations General Assembly controls for the degree of political alliance

[13] Aerospace/Defense; Automobiles; Chemicals; Clothing/Textiles; Computers/Electro-nics; Consumer Products; Food/Beverages/Tobacco; Machinery/Industrial Goods; Paper/Packaging; Pharmaceuticals; and Telecommunications.

[14] Distance, GDP, population, common border, common official language, former colonial ties, common legal origin, common currency and GATT/WTO membership. Note that GDP, market size and remoteness are also determinants of firms' choice of export quality across destinations, as shown by Manova and Zhang (2012).

with the United States. Following Schott (2004) on the determinants of unit prices, we include the capital/labor ratio of the exporting country and the fraction of its population having achieved at least secondary education. These data are constructed respectively from Penn World Tables 7.0 and from Barro and Lee (2010). Finally, the length of quality ladders from Khandelwal (2010) measures the extent of quality variation within 5-digit sectors, and therefore the scope for vertical differentiation.[15] Table 3.1 provides some descriptive statistics.

3.2.2.2 Unit Prices, Reputation and Quality

Table 3.2 reports the results of the industry-level specifications. As mentioned above, we include as independent variables GDP per capita, capital/labor endowment and education attainment, which affect the quality range of a country's production. We also include year and sector fixed effects and cluster standard errors by country. We show that export unit values, after controlling for these and gravity variables, are correlated with the type of news that appear in US printed media about the exporting country and its companies.

In column 1, we find that within industries, countries where a sector receives better coverage in US media charge higher unit values on the sector's exports, relative to countries receiving less favorable coverage. The coefficient is larger for negative quality news, about quality defects or scandals, than for positive news, about successes and quality control. We also find that unit prices are higher on imports from political allies (high correlation of UN votes) and lower on imports from countries with higher capital-labor ratios.[16]

In column 2, we interact the news variables with Khandelwal's quality ladder measure.[17]

[15]Khandelwal estimates the quality of US imports from price and market share data. Conditional on price, a product with higher market share is assigned higher quality. In our framework, it is more precisely a measure of perceived quality. The scope for vertical differentation (length of quality ladders) is then calculated from the heterogeneity in estimated product qualities within products.

[16]This result on capital-labor ratios seems to contrast with the existing literature. However, we can replicate Schott (2004)'s finding that higher capital-labor ratios are associated with higher unit values when the independent variables only include, beyond the capital/labor ratio, year and sector fixed effects, as in his paper. When we add country fixed effects or control for gravity variables, the positive coefficient on the capital-labor ratio disappears.

[17]Since the quality ladder variable is calculated at the industry level and is time-invariant, its direct effect is

Table 3.1: *Summary Statistics*

	Mean	St. dev.	Min	Max
Export unit value index	89.287	107.237	0.002	2795.957
Positive industry quality news	1.703	0.986	0	4.021
Negative industry quality news	3.126	3.578	0	40.323
Positive political news	1.554	0.888	0	4.001
Negative political news	0.401	0.680	0	3.097
Quality ladder	2.072	0.8776	0	5.803
Capital/labor ratio	60.952	36.482	0.438	153.856
Skilled fraction of population	50.161	19.156	2.001	92.656
UN vote correlation	0.223	0.347	-0.680	0.882

Notes: Positive and negative industry quality news are defined and normalized as in equation (3.1) and political news as in equation (3.2). Quality ladder is the length of industry-level quality ladders from Khandelwal (2010).

A longer quality ladder implies that the sector has more dispersion in quality, hence is more vulnerable to concerns about unobserved quality. Consistent with our interpretation in terms of asymmetric information, we find that the effect of industry-level news is magnified in sectors where there is more scope for vertical differentiation. According to the point estimates, a 10% increase in the quantity of positive (respectively, negative) quality-related news relative to other foreign countries is associated with a 0.3% increase (respectively 0.5% decrease) in the unit value of exports in a sector at the mean of quality ladders. For the sector with the longest quality ladder, i.e. the most vertical differentiation, the corresponding values are respectively a 0.8% increase and a 1.3% decrease in unit value.

It may be that these results are affected by the total volume of news coverage of a country if some countries are more heavily covered by US media because of a cultural or geographical proximity not captured by our controls, and are also more frequent and trusted trading partners. Controlling for the total amount of news concerning the country-sector pair, however, does not change any of the relevant coefficients (columns 3 and 4). Finally, in columns 5 and 6, we include political news at the country level, and find insignificant coefficients, confirming that the most relevant information is quality-related news rather

captured by industry fixed effects in the regressions.

than general country images. Note that we already proxy for political goodwill towards foreign countries with the correlation of UN votes.

Table 3.2: *Export Unit Prices and Country/Industry News Coverage*

	Unit value index					
	(1)	(2)	(3)	(4)	(5)	(6)
Positive industry quality news	0.035*	0.006	0.046	0.016	0.030*	0.000
	[0.018]	[0.019]	[0.030]	[0.029]	[0.016]	[0.017]
Negative industry quality news	-0.059***	-0.010	-0.053***	-0.007	-0.056***	-0.008
	[0.021]	[0.022]	[0.019]	[0.021]	[0.019]	[0.021]
Positive industry quality news*ladder		0.015***		0.015***		0.015***
		[0.005]		[0.005]		[0.005]
Negative industry quality news*ladder		-0.024***		-0.023***		-0.024***
		[0.006]		[0.006]		[0.006]
Total industry quality news			-0.008	-0.007		
			[0.025]	[0.025]		
Positive political news					0.099	0.098
					[0.064]	[0.064]
Negative political news					-0.087	-0.086
					[0.060]	[0.060]
Capital/labor ratio	-0.163***	-0.163***	-0.221***	-0.221***	-0.174***	-0.174***
	[0.053]	[0.052]	[0.061]	[0.061]	[0.054]	[0.054]
Skilled fraction of population	0.009	0.009	0.025	0.025	0.010	0.011
	[0.070]	[0.069]	[0.084]	[0.084]	[0.069]	[0.068]
UN vote correlation	0.252***	0.252***	0.282***	0.282***	0.230***	0.230***
	[0.084]	[0.084]	[0.089]	[0.089]	[0.084]	[0.084]
Observations	157 906	157 906	143 024	143 024	157 906	157 906
R-squared	0.261	0.261	0.264	0.264	0.261	0.261

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All regressions include year and industry fixed effects and gravity variables as described in footnote 13. Standard errors clustered by country are in brackets. All news variables, capital/labor ratio and the skilled fraction of the population are in logs.

In Table 3.3, we repeat the exercise with aggregate country news per year (both political and quality-related) instead of news covering specifically the industry. We find again that positive news about quality are associated with higher unit prices on exports and negative quality news with lower unit prices. Political news coverage does not enter significantly after including the UN vote measure of alliances. The coefficients do not vary in a significant manner according to the length of quality ladders. Thus, these results seem to indicate that national reputations are formed at the country-sector level rather than at the overall country level.

To sum up, we have shown that countries with a better quality reputation, mediated by news coverage, have higher unit prices after controlling for known determinants of country-wide quality. The link is stronger in sectors with large scope for vertical differentiation, supporting our interpretation of country reputations as a component of expected quality. Naturally, although reputation shocks may not be directly related to changes in the actual quality distribution of a country's exports, long-run perceived and actual quality go hand-in-hand and the contents of media articles are related to both. What we have shown is that after controlling for observable country characteristics, there is still a role for quality perceptions to influence unit prices. These results support the presence of imperfect information in international trade transactions. We proceed to formalize these insights in a model with asymmetric information.

3.3 Model Setup

3.3.1 Firms

We develop a model with two countries, Home and Foreign. We focus on the industry equilibrium in an export-oriented sector in Foreign, for which Home is the importer. The industry is composed of overlapping generations of foreign exporters. We do not model explicitly the domestic market of foreign firms: all firms in the industry produce for export

Table 3.3: *Export Unit Prices and Country News Coverage*

	Unit value index					
	(1)	(2)	(3)	(4)	(5)	(6)
Positive quality news		0.163*	0.195**	0.222**	0.251***	0.423**
		[0.088]	[0.086]	[0.088]	[0.085]	[0.171]
Negative quality news		-0.120	-0.119*	-0.170**	-0.166**	0.005
		[0.075]	[0.071]	[0.083]	[0.080]	[0.120]
Positive quality news*ladder				-0.030	-0.029	-0.028
				[0.021]	[0.021]	[0.021]
Negative quality news*ladder				0.025	0.024	0.023
				[0.021]	[0.021]	[0.021]
Positive political news	0.110		0.006		0.005	0.004
	[0.069]		[0.062]		[0.062]	[0.056]
Negative political news	-0.089		-0.052		-0.052	0.029
	[0.064]		[0.054]		[0.055]	[0.041]
Total news						-0.421
						[0.301]
Capital/labor ratio	-0.173***	-0.164***	-0.172***	-0.164***	-0.173***	-0.174***
	[0.053]	[0.046]	[0.047]	[0.046]	[0.047]	[0.046]
Skilled fraction of population.	-0.004	0.009	0.021	0.009	0.021	0.023
	[0.066]	[0.060]	[0.057]	[0.060]	[0.057]	[0.054]
UN vote correlation	0.155*	0.170*	0.142*	0.170*	0.142*	0.138*
	[0.084]	[0.087]	[0.080]	[0.086]	[0.080]	[0.077]
Observations	204 237	203 883	203 460	203 883	203 460	203 460
R-squared	0.261	0.262	0.262	0.262	0.263	0.263

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All regressions include year and industry fixed effects and gravity variables as described in footnote 13. Standard errors clustered by country are in brackets. All news variables, capital/labor ratio and the skilled fraction of the population are in logs.

only.[18]

There is a constant number E of potential exporters being born every period. Each new firm draws a quality parameter θ from a distribution $G(\theta)$ with support on $[\theta_m, \infty)$ and density $g(\theta)$, and has the option to produce a good of quality level θ.[19] At the beginning of every period, firms decide whether to stay active and export, or shut down. Each firm has capacity 1, so that it can choose to sell either one unit or nothing.

If it produces and sells, a firm j of type θ incurs a cost $w\theta + k$, including both production and transport costs. k includes all costs that are independent of quality, while $w\theta$ is the portion of costs that increases with the quality of the product (e.g. quality control processes, better intermediate inputs, more skilled workers). Hence, profits at period $t+s$ of an active firm j born at date t are:

$$\pi_{t+s}(j) = p_{t+s}(j) - w\theta(j) - k \tag{3.3}$$

where $p_{t+s}(j)$ is the price at which firm j sells its output. The price-setting mechanism is described in the next subsection.

A firm can freely exit at any period and realize zero profits from this period onwards. However if it chooses to exit the export market in a given period, it cannot re-enter later.[20] Moreover, each firm has an exogenous probability $1-\delta$ of disappearing every period, independent of both quality and the firm's age. The probability that a firm still exists from one period to the next, conditional on not choosing to exit, is δ. There is no additional discount rate.

[18]We could easily extend the model to allow firms to serve their domestic market as long as the decisions to enter the domestic and export markets are separable. The key assumption is that there is no information flowing between buyers located in different geographic markets. In particular, a firm having established a reputation in its domestic market would not be able to transfer this reputation to export sales.

[19]For simplicity we do not model the choice of quality. We can think of the exogenous quality draw as determined on the domestic market before considering the decision to export, or as a technology blueprint which comes from an R&D process with uncertain outcome: all firms invest the same sunk cost in R&D and randomly, some come up with better quality products than others.

[20]This assumption is inconsequential for the steady-state analysis. It rules out coordination problems among high-quality firms along the transition path.

3.3.2 Buyers

In Home, there is a pool of importers each of which demands one unit of the good. We assume that there are no tariffs.[21] Potential demand for imported goods in Home is assumed to be large, in the sense that the market size is sufficient for all foreign exporters to find a buyer at a price that does not exceed the expected value of their goods. The true utility from consuming the product is θ but is not observable before purchase. We can think of θ as characteristics that are observed only upon consumption, or for durable goods, as the inverse of the probability of breakdown per period.

At the beginning of every period, each active firm is randomly matched to a buyer in Home. The firm cannot sell to another importer in that period, nor can the buyer purchase from another exporter before the next period. The firm then sets the price equal to the expected value of the good for its buyer. The indirect utility buyer i receives from variety j is:

$$u^i(j) = \theta(j) - p(j) \tag{3.4}$$

which can be derived from an additively separable utility function where buyer i consumes a numeraire good and one unit of the imported differentiated good. As $\theta(j)$ is not observed, the maximum price that an importer i is willing to pay for the output of firm j at time $t+s$ is given by its expected quality from the perspective of the buyer:

$$p_{t+s}(j) = E^i_{t+s}\left[\theta(j) \,|I^i_{t+s}\right] \tag{3.5}$$

where I^i_{t+s} is the information set of buyer i at time $t+s$. We assume that firms hold all the bargaining power and receive the full expected surplus of the transaction.[22].

There are two types of buyers, informed and uninformed. Uninformed buyers (noted

[21] Ad valorem tariffs are introduced in Appendix C.3.

[22] Long-term contracts between exporters and importers are ruled out in this setting: all contracts are one-period sales contracts and firms are matched to customers for one period only. In particular, there cannot be price schedules resembling an introductory pricing strategy, whereby buyers would pay a low price in the initial period and offer a sequence of prices contingent on their future consumption experience.

U) have no information specific to firm j: they do not know its quality or how long it has been an active exporter. The only information at their disposal is the "national reputation", i.e. a prior μ_{t+s} about expected quality among all foreign exporters. μ_{t+s} is common across buyers and will be endogenized in Section 3.4. Informed buyers (noted I) know the true quality of firm j, either because they have past experience from consumption of good j or because they have received information from another importer who has. Hence, the relevant information sets of both types of buyers are:

$$\begin{aligned} I^{U}_{t+s}(j) &= \{\mu_{t+s}\} \\ I^{I}_{t+s}(j) &= \{\theta(j), \mu_{t+s}\} \end{aligned}$$

The price received by firm j matched with buyer i in period $t+s$ is therefore equal to its quality if i is informed, and to the country's reputation if i is uninformed. Equation (3.5) can thus be rewritten as:

$$p_{t+s}(j) = \begin{cases} \mu_{t+s} & \text{if } i \in U \\ \theta(j) & \text{if } i \in I \end{cases} \tag{3.6}$$

In the first period when a firm j enters the market, all importers are uninformed about j. Then, if firm j has exported s times in the past, a fraction $\rho(s)$ of buyers are informed, where we make the following natural assumption:

Assumption 1: $\rho' \geq 0$, $\rho(0) = 0$, and $\lim_{s\to\infty} \rho(s) = 1$.

The fraction of informed buyers increases as the firm gains export experience. [23] Note that a concave $\rho(s)$ would capture the idea that a firm having already exported is more likely to be matched again with one of its previous buyers or with someone close to a previous buyer in terms of informational diffusion. Hence the rate at which the scope of

[23] A possible microfoundation for the $\rho(s)$ function is that importers belong to distinct groups within which information diffusion takes place. The fraction of informed buyers rises according to the probability of sampling a buyer from an uninformed versus an informed group. See Appendix C.2 for a formal development.

informed buyers expands would decrease with the number of periods the firm has been on the market. However, the only conditions needed for our analysis is that ρ is monotonically increasing and takes values between 0 and 1.

For expositional simplicity we drop the j notation in the next sections and refer to "firm θ" instead of "firm j with quality parameter θ" whenever possible.

3.3.3 Timing

For a given cohort of firms born at date t, the timing of moves proceeds as follows:

- At t, each new firm j draws a parameter $\theta(j)$ and decides whether to export or not.
- For each $s \geq 1$, at time $t+s$:
  - Each active firm j is matched with a buyer i and observes whether i is informed or uninformed.
  - The price is set at $E^i_{t+s}\left[\theta(j) \mid I^i_{t+s}\right]$, and production and sales take place.
  - For each good j that was sold, the fraction of informed buyers rises from $\rho(s)$ to $\rho(s+1)$.
  - The exogenous death shock is realized. Firms that survive decide whether to stay active.
  - New firms are born (cohort $t+s$).

3.3.4 Perfect Information

Under perfect information, all $\theta(j)$ are observable by all parties. All firms receive a price $p^*_{t+s}(j)$ equal to true quality regardless of how long they have been exporting:

$$p^*_{t+s}(j) = \theta(j) \text{ for all } s$$

Therefore, it follows from (3.3) that firms are active exporters if and only if $\theta \geq \theta^*$, where the perfect information threshold is defined as:

$$\theta^* \equiv \frac{k}{1-w} \tag{3.7}$$

Under perfect information, the model therefore predicts a sorting of firms into non-exporters and exporters similar to that of Melitz (2003). We can define productivity as the inverse of the cost per unit of quality $w + \frac{k}{\theta}$. The firms with the highest quality θ are also those with the highest productivity. Firms above the quality threshold θ^*, or equivalently below the quality-adjusted cost threshold $w + \frac{k}{\theta^*}$, are and remain exporters, while firms below the threshold never export.

3.3.5 Imperfect Information: Price and Profits

Under asymmetric information, suppose μ_t is the buyers' prior about the expected quality of a good from the foreign country at time t. This prior is the national reputation or "national brand"and is taken as exogenous by individual firms. We derive its equilibrium value in the next section, as a function of the quality distribution of exports. The price offered to a firm j born at date t is either the country-wide prior if the buyer is uninformed, or its true quality if the buyer is informed. The probability of receiving a price which reflects the firms' true quality increases with the firm's export experience. In the first period in which firm j is active, no buyer has any information specific to the firm, so that the price only depends on the prior:

$$p_{t+1}(j) = \mu_{t+1} \tag{3.8}$$

Then in the following periods, conditional on firm j still being active, the pricing equation (3.6) implies that the price received by firm j is set according to the following rule:

$$p_{t+s}(j) = \begin{cases} \theta & \text{with probability } \rho(s-1) \\ \mu_{t+s} & \text{with probability } 1-\rho(s-1) \end{cases} \quad \text{for } s \geq 1 \tag{3.9}$$

where $\rho(s-1)$ is the fraction of informed buyers for a firm that has previously exported $s-1$ times. In particular, a firm that exports for the first time faces only uninformed importers ($\rho(0)=0$). As $\lim_{s\rightarrow\infty}\rho(s)=1$, the expectation of the price converges to the perfect information price $\theta(j)$ over time if firm j stays in the market indefinitely.

Expected profits of firm j in future periods, conditional on remaining active, are the difference between its expected price and its production cost:

$$E_t^j \pi_{t+s}(j) = (\rho(s-1) - w)\,\theta(j) + (1-\rho(s-1))\,E_t\mu_{t+s} - k \tag{3.10}$$

Expected profits place a larger weight on true quality and a smaller weight on national reputation as the firm gains tenure into exporting. It immediately follows that if reputation is time-invariant, a firm with quality above the country prior ($\theta(j) > \mu$) expects to realize an increasing sequence of profits over time, while a firm with quality below the country prior ($\theta(j) < \mu$) expects decreasing profits. For all active firms, if μ is constant, the price is monotonically converging towards θ and profits are monotonically converging towards their perfect information value $(1-w)\,\theta - k$.

We also assume that the updating parameter is large enough relative to the cost of producing quality:

Assumption 2: $\rho(1) > w$

This assumption ensures that expected profits from repeat purchases – as opposed to initial purchases – are increasing in true quality.

3.4 Industry Equilibrium

In this section, we define a steady-state industry equilibrium as one in which national reputation is pinned down by the average quality of a country's exports and the quality distribution is stationary. We lay out the existence conditions for high-quality and low-quality steady-state equilibria and characterize the price, entry and exit patterns in each equilibrium type.

3.4.1 Equilibrium Definition

Country reputations are taken as exogenous by individual firms. In each period t, let $M_t(\theta, s)$ be the number of active firms of quality θ having previously exported s times. Given an underlying quality distribution $G(\theta)$ and pdf $g(\theta)$, we derive $\overline{\theta}_t$ as the average quality of exports across quality levels and cohorts of firms:

$$\overline{\theta}_t = \frac{\int_{\theta_m}^{\infty} \theta \left[\sum_{s=0}^{\infty} M_t(\theta, s) \right] d\theta}{\int_{\theta_m}^{\infty} \left[\sum_{s=0}^{\infty} M_t(\theta, s) \right] d\theta} \tag{3.11}$$

Country reputations evolve according to the actual quality of exported goods in the previous period[24]:

$$\mu_{t+1} = \mu_t + \eta \left(\overline{\theta}_t - \mu_t \right) \tag{3.12}$$

where $\eta < 1$ and $\overline{\theta}_t$ is the average quality of foreign firms' exports at period t. Reputation rises (respectively, falls) from one period to the next if the average quality of exported goods in the previous period was higher (respectively, lower) than expected. Setting $\eta < 1$ captures the slow-moving aspect of reputations and only matters for equilibrium stability. Along with $\overline{\theta}_t$, this determines μ_{t+1} according to (3.11).

In each period, a firm of quality θ having exported s times in the past stays active if the expected present value of doing so, $PV_t(\theta, s)$, is positive. The firm is free to exit at any future date. Let $T(\theta)$ be the exit date (possibly infinity) that maximizes the firm's intertemporal problem. Then $PV_t(\theta, s)$ is the discounted sum of current and future profits in (3.10) up to the optimal exit date:

$$PV_t(\theta, s) = \sum_{u=0}^{T(\theta)} \delta^u \left[(\rho(s+u) - w)\theta + (1 - \rho(s+u)) E_t \mu_{t+u} - k \right] \tag{3.13}$$

Since there is no aggregate uncertainty, $E_t \mu_{t+u} = \mu_{t+u}$ for all u. There are E new firms per period, with quality draws distributed according to the pdf $g(\theta)$. A new firm of quality θ is

[24] This equation is a reduced form for consumers' updating process, where the implied simplifying assumption is that η is constant. This hypothesis is not necessary for our main steady-state results and only ensures that equilibrium stability holds under general conditions.

active at $t+1$ if $PV_{t+1}(\theta,0)>0$. Hence the number of active new firms per quality level is:

$$M_{t+1}(\theta,0)=\begin{cases} Eg(\theta) & \text{if } PV_{t+1}(\theta,0)>0 \\ 0 & \text{if } PV_{t+1}(\theta,0)\leq 0 \end{cases} \tag{3.14}$$

Among incumbent firms of quality θ having exported s times, $\delta M_t(\theta,s-1)$ survive from period t to period $t+1$. They remain active if $PV_{t+1}(\theta,s)>0$ in equation (3.13). Thus the number of active old firms is, for $s\geq 1$:

$$M_{t+1}(\theta,s)=\begin{cases} \delta M_t(\theta,s-1) & \text{if } PV_{t+1}(\theta,s)>0 \\ 0 & \text{if } \ PV_{t+1}(\theta,0)\leq 0 \end{cases} \tag{3.15}$$

Equations (3.12), (3.11), (3.14) and (3.15) determine $\overline{\theta}_{t+1}$ and μ_{t+2}. We can then define the industry steady-state as an equilibrium with constant reputation and a constant distribution of quality.

$\left\{\mu,\{M(\theta,s)\}_{s,\theta}\right\}$ is a steady-state equilibrium if and only if:

(i) For all $\theta\in[\theta_m,\infty)$ and all $s\geq 0$, if $M_t(\theta,s)=M(\theta,s)$ and $E_t\mu_{t+u}=\mu$ for all $u\geq 0$, then $M_{t+1}(\theta,s)=M(\theta,s)$ in (3.14) and (3.15);

(ii) If $M_t(\theta,s)=M(\theta,s)$ for all $\theta\in[\theta_m,\infty)$ and all $s\geq 0$, then $\overline{\theta}_t=\mu$ in (3.11).

Condition (i) ensures that the number of firms in each quality-age segment is constant in the steady state. Condition (ii) states that the average quality resulting from an equilibrium distribution of active firms is equal to the equilibrium country reputation. It guarantees that μ is constant in a steady state. In other words, a steady state with national reputation μ is a rational expectations equilibrium if the average quality of active exporters is equal to buyers' quality expectation. The endogenous entry and exit decisions induced by μ justify the reputation ex post.

From this point on, we assume that the quality draw of entrants has a Pareto distribution with support on $[\theta_m,\infty)$ and shape parameter $\alpha>1$:

$$G(\theta)\equiv 1-\left(\frac{\theta_m}{\theta}\right)^{\alpha} \tag{3.16}$$

We note μ_0 the unconditional expectation of quality draws: $\mu_0\equiv\frac{\alpha}{\alpha-1}\theta_m$.

3.4.2 High-Quality Equilibrium

We call "high-quality equilibrium" (HQE) a steady-state equilibrium where the country reputation μ exceeds the perfect information quality threshold θ^*.

$\left\{\mu, \{M(\theta, s)\}_{s,\theta}\right\}$ is a high-quality steady-state equilibrium if $\mu > \theta^*$ and $\left\{\mu, \{M(\theta, s)\}_{s,\theta}\right\}$ is a steady-state equilibrium according to Definition 3.4.1.

We first characterize firms' entry and exit decisions in a high-quality equilibrium given μ. We then proceed to derive the existence conditions for a HQE.

3.4.2.1 Entry and Exit

In a HQE, national reputation is high and time-invariant, i.e. $\mu_t = \mu > \theta^*$ for all t. Therefore, a firm with quality equal to the country's reputation would be viable in a perfect information setting. All firms receive high prices as they enter the export market, which encourages entry. Formally, we prove the following.

Lemma 3 *In a HQE with country reputation $\mu > \theta^*$, (i) All entrants are initially active; (ii) Firms with $\theta < \theta^*$ expect to exit after a number of periods $T(\theta)$ weakly increasing in quality θ; (iii) Firms with $\theta > \theta^*$ stay in the market until hit by the exogenous shock.*

Proof: see Appendix C.1.1.

The sorting of firms according to their quality parameter is represented in Figure 3.1. Low-quality firms below θ^* find it profitable to enter initially as they have low production costs and can therefore reap positive profits as long as buyers do not have information about their type. The higher the country reputation, the higher the price they receive in the first period. As first-period profits are decreasing in quality, low-θ firms always find it profitable to enter the market as fly-by-nights. However, given the expected profit equation (3.10) and Assumption 2, profits from repeat purchases are increasing in quality and converging over time towards their perfect information value. Hence, all firms below θ^*, which would not survive under perfect information, face a decreasing sequence of profits converging to a negative value. They will eventually see their expected present value of profits turn negative

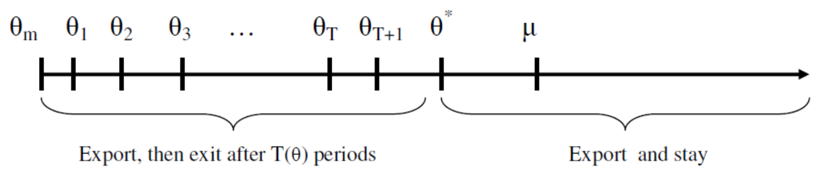


Figure 3.1: *Sorting of firms by θ with high national reputation*

and exit. The number of periods $T(\theta)$ that a firm with quality $\theta < \theta^*$ stays active is pinned down by the condition that its expected profit is positive for the first $T(\theta)$ periods it exports, and negative in all following periods.

Let us define θ_T as the highest quality type that exits after selling for T periods – or the lowest quality type that exits after selling for $T+1$ periods:

$$\theta_T = \max\left\{\frac{k - (1-\rho(T))\,\mu}{\rho(T) - w}, \theta_m\right\} \quad \text{for } T \geq 1 \tag{3.17}$$

and $\lim_{T\to\infty} \theta_T = \theta^*$.

For high-quality firms above θ^*, it is always profitable to enter and keep exporting. Firms between θ^* and μ have expected profits declining over time, but positive in every period. Firms above μ have expected profits increasing over time. The highest quality firms incur losses in the initial period but recoup these losses in later periods once enough buyers have received information about their type. Their expected intertemporal profits are always positive. Thus, firms above θ^* never exit before they are forced to by the exogenous shock, as their per-period profits are converging towards the strictly positive perfect information level.

3.4.2.2 Average Quality

In a steady state indexed by $\mu > \theta^*$, the number $M(\theta, s)$ of active firms of quality θ having already exported s times is derived from Lemma 3 and equations (3.14) and (3.15):

$$M(\theta, s) = \begin{cases} \delta^s E g(\theta) & \text{if } \theta < \theta^* \text{ and } s < T(\theta) \\ 0 & \text{if } \theta < \theta^* \text{ and } s \geq T(\theta) \\ \delta^s E g(\theta) & \text{if } \theta \geq \theta^* \end{cases} \tag{3.18}$$

so that the total number of active firms of quality θ is $\frac{1-\delta^{T(\theta)}}{1-\delta} E g(\theta)$ if $\theta < \theta^*$, and $\frac{1}{1-\delta} E g(\theta)$ if $\theta \geq \theta^*$. Using (3.11) and (3.16), we derive the steady-state average quality of exports in a HQE as a function of μ and exogenous parameters:

$$\overline{\theta}(\mu) = \mu_0 \left(\frac{1 - \sum_{T=0}^{\infty} \delta^{T+1} \left[\left(\frac{\theta_m}{\theta_T} \right)^{\alpha-1} - \left(\frac{\theta_m}{\theta_{T+1}} \right)^{\alpha-1} \right]}{1 - \sum_{T=0}^{\infty} \delta^{T+1} \left[\left(\frac{\theta_m}{\theta_{T+1}} \right)^{\alpha} - \left(\frac{\theta_m}{\theta_{T+1}} \right)^{\alpha} \right]} \right) \tag{3.19}$$

where $\theta_0 \equiv \theta_m$ and θ_T, θ_{T+1} are defined by (3.17). The average quality of active firms is higher than the mean of the unconditional distribution of θ, as lower-quality firms exit earlier than high-quality firms. However, it lies below the perfect information average export quality.

3.4.2.3 Existence Conditions

There exists a HQE if there is a fixed point of $\overline{\theta}(\mu)$ in equation (3.19) such that $\mu = \overline{\theta}(\mu) > \theta^*$. Proposition 4 establishes existence conditions.

Proposition 4 *There is a unique HQE if and only if $\overline{\theta}(\theta^*) > \theta^*$, or equivalently if and only if*

$$\alpha \left(\frac{\theta_m}{\theta^*} \right) + \frac{\delta}{1-\delta} \left(\frac{\theta_m}{\theta^*} \right)^{\alpha} > \alpha - 1 \tag{3.20}$$

Proof: see Appendix C.1.3.

An equilibrium steady-state reputation is a reputation μ such that $\overline{\theta}(\mu) = \mu$. The intuition of the proof is as follows. Starting from a reputation above θ^*, raising μ has a negative effect on actual quality. Improving national reputation, for a given distribution of θ draws, does not affect the decisions of firms above θ^* to stay or exit, as they are already remaining active as long as possible. However, it encourages lower-quality firms to stay longer: for firms below θ^*, a higher μ raises all $T(\theta)$, implying that low-quality firms wait longer before exiting the market. In short, the incentives of high-quality firms are not affected but those of low-quality firms result in a higher export duration of firms producing "bad" varieties. Hence, the average quality of exported goods falls when μ increases. It follows that $\overline{\theta}(\mu)$ is strictly decreasing on $[\theta^*, \infty)$ and therefore if $\overline{\theta}(\theta^*) > \theta^*$, there is a unique fixed point of $\overline{\theta}(\mu)$ in the high quality region. This fixed point is the unique HQE.

The HQE existence condition (3.20) holds for δ high enough, α low enough, and/or w and k low enough. A high δ implies that exogenous exit is relatively less prevalent than endogenous exit, increasing the relative mass of high-quality firms. A low α means that there is high dispersion in the prior distribution of θ and therefore more firms at the right tail of the distribution pushing up the mean. A low w reduces the relative cost advantage of low-quality firms, as well as the loss incurred in initial periods by high-quality firms. Lower w and k also lower the perfect information threshold θ^*, making it more likely that the economy ends up in a high-quality equilibrium.

3.4.3 Low-Quality Equilibrium

We call "low-quality equilibrium" (LQE) a steady-state equilibrium where the country reputation falls short of the perfect information quality threshold θ^*.

$\left\{\mu, \{M(\theta, s)\}_{s,\theta}\right\}$ is a low-quality steady-state equilibrium if $\mu < \theta^*$ and $\left\{\mu, \{M(\theta, s)\}_{s,\theta}\right\}$ is a steady-state equilibrium according to Definition 3.4.1.

As in the high-quality case, we first detemine the entry and exit patterns given μ and then derive existence conditions.

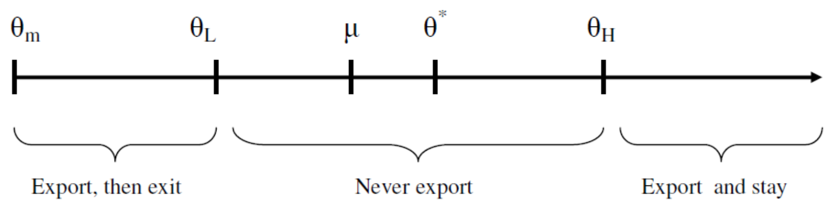


Figure 3.2: *Sorting of Firms by θ with Low National Reputation*

3.4.3.1 Entry and Exit

In a LQE, national reputation is low and constant, i.e. $\mu_t = \mu < \theta^*$ for all t. A firm with quality μ would never export in a perfect information setting. Under asymmetric information, we can show the following:

Lemma 4 *In a LQE with country reputation $k + w\theta_m < \mu < \theta^*$, (i) Firms with quality $\theta < \theta_L$ enter the export market and exit after selling for one period, where*

$$\theta_L \equiv \frac{\mu - k}{w} < \mu < \theta^* \tag{3.21}$$

(ii) Firms with quality $\theta > \theta_H$ enter and stay in the market until hit by the exogenous shock, where

$$\theta_H \equiv \frac{k - \mu\left(1 - A_\rho\right)}{A_\rho - w} > \theta^* \tag{3.22}$$

and $A_\rho \equiv (1-\delta)\sum_{s=0}^{\infty}\delta^s\rho(s)$. (iii) Firms with quality $\theta_L \leq \theta \leq \theta_H$ never enter the market.

Proof: see Appendix C.1.2.

Figure 3.2 shows the sorting of firms by quality into "fly-by-nights", non-exporters and continuous exporters. Fly-by-night firms exist as long as $\mu > k + w\theta_m$, which ensures that some low-quality firms realize positive first-period profits. These firms would not survive under perfect information but gain from the information asymmetry. However, given $\mu < \theta^*$ and Assumption 2, they would make losses if they were to stay active in the second period, after buyers have received a firm-specific signal. Firms below θ_L therefore exit immediately after selling once.

All firms with better quality than the country reputation μ are not profitable in the first period when they enter export markets. Above θ_H, the present value of expected profits is positive: expected profits from sales in later periods, when a larger portion of the price reflects true quality, exceed initial losses. The negative profits in their first periods of existence can be interpreted as investments in building a brand name or firm-specific reputation, distinct from the country reputation.

An intermediate range of firms $[\theta_L, \theta_H]$ around θ^* never become active exporters. Those with $\theta_L < \theta < \theta^*$ have negative expected profits at all periods, while those with $\theta^* < \theta < \theta_H$ would be profitable in the long run once enough buyers have gathered information about their type. However, for the latter, the present value of their profit stream is negative: losses incurred in the initial periods in order to establish a reputation are not made up for with later profits (due to the exogenous exit shock which acts similarly to a discount rate). Hence this range of firms is kept out of export markets by the information asymmetry and the cost of revealing quality.

Lastly, if $\mu < k + w\theta_m$, then there are no active firms below θ^*, given that national reputation is too low for any firm to realize positive first-period profits. This results in a high average quality of exported goods. Therefore, there cannot be an equilibrium with endogenous reputation in this region.

3.4.3.2 Average Quality

In a steady state indexed by $\mu < \theta^*$, the number $M(\theta, s)$ of active firms of quality θ having already exported s times is derived from Lemma 4 and equations (3.14) and (3.15):

$$M(\theta, s) = \begin{cases} Eg(\theta) & \text{if } \theta < \theta_L \text{ and } s = 0 \\ 0 & \text{if } \theta < \theta_L \text{ and } s \geq 1 \\ 0 & \text{if } \theta_L \leq \theta \leq \theta_H \\ \delta^s Eg(\theta) & \text{if } \theta > \theta_H \end{cases} \tag{3.23}$$

so that the number of active firms of quality θ is $Eg(\theta)$ if $\theta < \theta_L$ and $\frac{1}{1-\delta}Eg(\theta)$ if $\theta > \theta_H$. Using (3.11) and (3.16), we derive the steady-state average quality of exports in a LQE as a function of μ and the economy's exogenous parameters:

$$\overline{\theta}(\mu) = \mu_0 \left(\frac{1 - \left(\frac{\theta_m}{\theta_L}\right)^{\alpha-1} + \frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha-1}}{1 - \left(\frac{\theta_m}{\theta_L}\right)^{\alpha} + \frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}} \right) \tag{3.24}$$

where θ_L, θ_H are defined respectively by (3.21) and (3.22). The volume of sales and average quality are lower than in high-reputation equilibria, due both to the existence of a gap in the distribution of active exporters, and to the fact that low-quality firms exit after selling for one period only.

3.4.3.3 Existence Conditions

The industry has at least one LQE if there exists a fixed point of $\overline{\theta}(\mu)$ in equation (3.24) such that $\mu = \overline{\theta}(\mu) < \theta^*$. Specifically:

Proposition 5 *If $\overline{\theta}(\theta^*) < \theta^*$, there exists at least one LQE.*

Proof: see Appendix C.1.4.

In other words, if condition (3.20) does not hold, there is an odd number of LQE and no HQE. The lowest possible level of national reputation ($\mu = \theta_m$) results in the highest average quality, as it drives out all low-quality firms and some high-quality firms. Hence $\overline{\theta}(\theta_m) > \theta_m$ and if $\overline{\theta}(\theta^*) < \theta^*$, there must be at least one fixed point in (θ_m, θ^*). However, the equilibrium may not be unique, since $\overline{\theta}(\mu)$ is not monotonic over the interval. In the low reputation region, increasing μ has two consequences with opposite effects on average quality. First, it enables more firms to realize positive profits from first-period sales (higher θ_L). This fosters entry by firms with below-average quality, given that $\theta_L < \mu$ in a LQE, and it lowers the expected quality of active firms. Second, increasing μ reduces the loss incurred by high-quality firms before they have been able to signal their quality to buyers, allowing more firms with above-average quality to be active (lower θ_H). The net change in $\overline{\theta}$

depends on the balance between these two effects. As long as the economy remains in the low reputation region ($\mu < \theta^*$), there is no effect of a better reputation on the exit rates of exporters: all active firms below θ^* sell for one period only, while all active firms above θ^* stay as long as they are able to.

3.4.4 Summary: Industry Steady-States

To sum up, depending on parameters, the rational expectations steady-state falls into one of two categories. The type of equilibrium will depend on whether the (not necessarily unique) fixed point of $\overline{\theta}(\mu)$ falls left or right of θ^*. In a "high-quality equilibrium", all firms produce and sell for at least one period, firms above θ^* remain active until they are exogenously forced to exit, and firms below θ^* exit in finite time after a number of periods increasing in θ. In a "low-quality equilibrium", there is a gap around θ^* where firms are never active. Below θ_L, they exit after exporting for a single period. Above θ_H, they only exit exogenously.

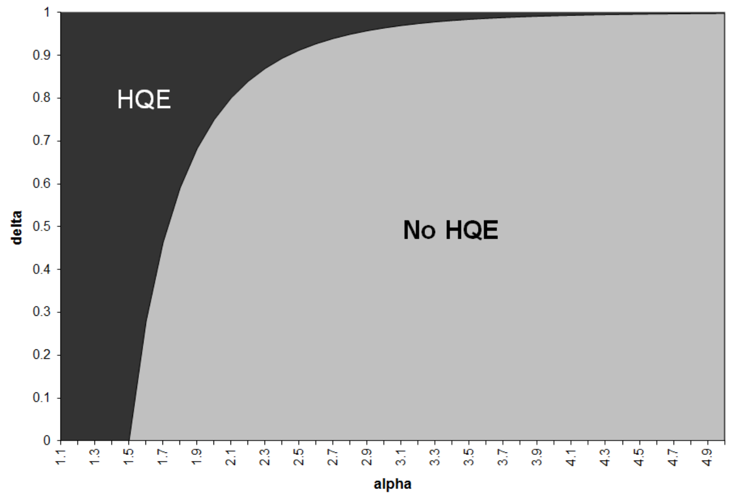
In general, we cannot rule out multiple equilibria. If $\overline{\theta}(\theta^*) < \theta^*$, there are an odd number of LQEs. If $\overline{\theta}(\theta^*) > \theta^*$, there is one HQE and there are either zero or an even number of LQEs. [25] These multiple equilibria give rise to the possibility of self-fulfilling reputation shocks, examined in Section 3.5.

Figure 3.3 illustrates the existence condition (3.20). In the dark region, the condition holds and a unique HQE exists. This is true for low enough α and high enough δ. In the light grey region, there is no HQE: the steady-state of the economy is necessarily a LQE. A higher k or w shifts the border to the left and expands the no HQE region. Conversely, lowering k or w widens the HQE region.

3.4.5 Additional Predictions: Unit Prices and Hazard Rates

The model yields additional predictions on the patterns of price and exit rates. Although these results are not the main focus of our paper, their consistency with existing empirical

[25] A graphical example of multiple equilibria is shown in Figure 3.7.



Notes: Parameter values: $\theta_m = 1$, $k = 1.5$, $w = 0.5$.

Figure 3.3: *Parameter values for HQE and LQE*

evidence lends support to our theory. First, we characterize the path of prices for a given cohort of firms.

Theorem 6 ***Unit prices***. *In a steady-state low-quality equilibrium, the average unit price charged at $t+s$ by firms born at date t is strictly increasing in s. In a steady-state high-quality equilibrium, the average unit price charged at $t+s$ by firms born at date t is strictly increasing in s for all s if $\mu > \frac{\alpha}{\alpha-1}\theta_1$ and for $s \geq T\left(\frac{\alpha-1}{\alpha}\mu\right)$ otherwise.*

Proof: See Appendix C.1.5.

At the firm level, there is a brand premium for high-quality firms both in a HQE and in a LQE: the price charged increases over time for a given good provided that its quality is higher than the country average. Result 6 establishes that on average, incumbents receive higher prices than entrants, and the average price among a cohort of firms is higher, the longer the cohort has been active on export markets. This result follows from the fact that over time, an increasing fraction of prices reflect firms' true quality parameters, and the average quality of a cohort of firms weakly increases over time as the lowest quality firms exit.

Interestingly, these predictions are supported by the findings of Foster *et al.* (2008) on the behavior of US firms in their domestic market. They show that entering businesses have significantly lower prices than incumbents, and that prices rise with plant age.

Second, our model implies that firms' exit rates vary systematically with their quality and across cohorts.

Theorem 7 ***Hazard rate****. In a steady-state equilibrium, the aggregate hazard rate is weakly decreasing in quality and in firms' export experience.*

Proof: See Appendix C.1.6.

The first part of Result 7 establishes that across cohorts, the fraction of active firms that exit per period is higher for lower-quality firms, both in a LQE and in a HQE. Low-quality firms exit voluntarily in finite time while high-quality firms only exit when hit by the exogenous death shock. The second part states that the probability of exit, across quality levels, decreases with the age of a cohort. It derives from the fact that the distribution of quality among older cohorts has a higher lower bound than among younger cohorts.

This last prediction is consistent with the findings of Besedes and Prusa (2004) on survival rates in US import relationships at the disaggregated product level. They estimate that the probability that the import relationship will end falls with its duration for differentiated products. We confirm these results with our product-level data: within HS-2 manufacturing industries, the average hazard rate of HS-10 products drops from 31% in the first year the country exports the good to 8% after 10 years (see Appendix C.4 for details).

3.5 Policy Implications

How can countries improve their "national brand name" – and is it worth it? First-best policies would involve conducting verifiable quality audits or taxing low-quality firms and subsidizing high-quality ones. These policies are not feasible when policy-makers are not better informed than consumers about firms' quality levels. Here, we look at the effects of two main policy instruments on reputation, quality and welfare: export subsidies and export promotion campaigns creating reputation shocks.

3.5.1 Export Subsidy

Consider a permanent[26] unanticipated subsidy to fixed export costs, resulting in a lower effective k for active exporters, financed by non-distortionary lump-sum taxes. Since there are no domestic consumers in our model and foreign consumers are not taken into account in national welfare calculations, welfare considerations abstract from changes in consumer surplus. We will compare the effect of the subsidy on aggregate industry profits and its direct cost in the steady states before and after the subsidy.

3.5.1.1 Starting from a LQE

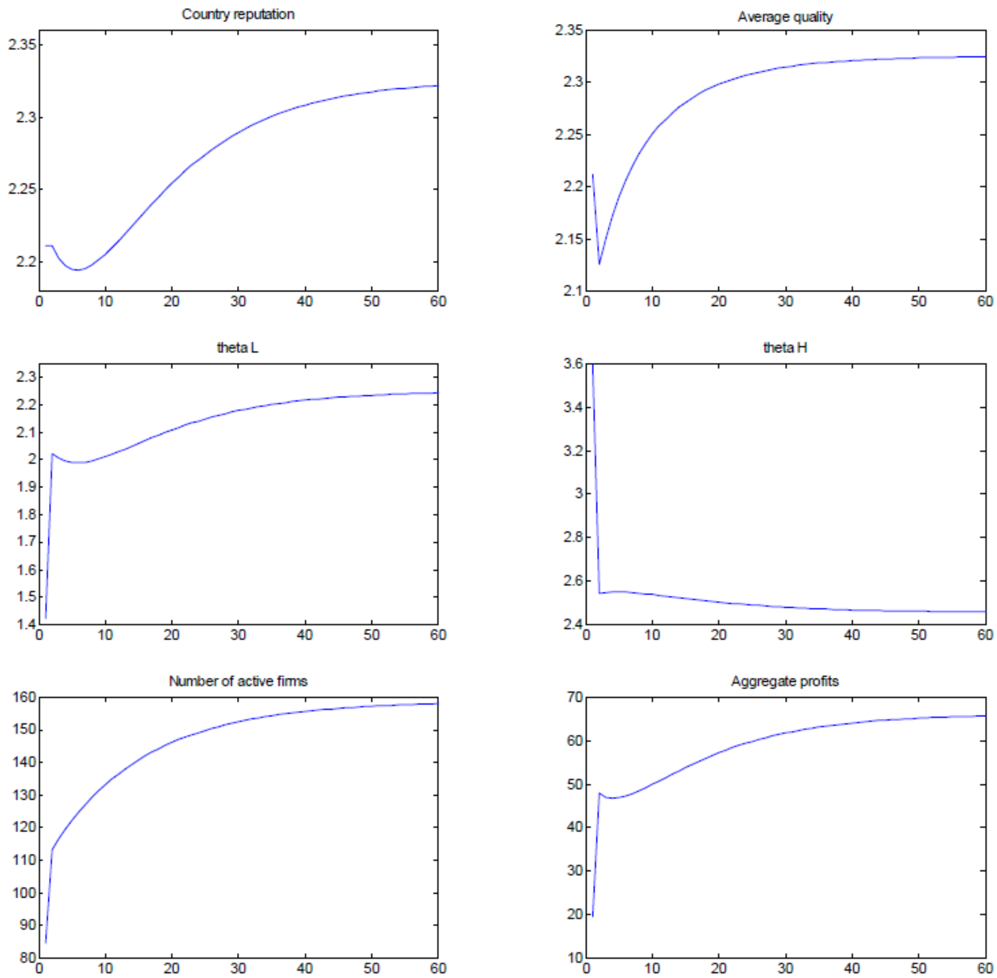
In a LQE, a decrease in k induces more high-quality firms to start and continue exporting (lower θ_H) and more low-quality firms to export for one period (higher θ_L). We prove that the overall effect on average quality, and thus steady-state national reputation, is positive with Pareto-distributed quality draws and δ not too low: starting from a LQE, an export subsidy increases long-run equilibrium quality.

Proposition 8 *An export subsidy in a LQE increases the steady-state average quality and welfare of the exporting country.*

Proof: see Appendix C.1.7.

The welfare result is a consequence of the higher long-run reputation. The entry response to the subsidy creates a positive externality on firms that would be exporting regardless of the policy. They receive higher prices on their exports due to improved reputation. This externality lies at the core of the beneficial effect of an export subsidy for a country that is in a low equilibrium. New exporters also benefit from the better reputation as well as the

[26] We are comparing the long-run industry equilibria with and without the policy. With a temporary subsidy, if the equilibrium is unique, the economy would return to the initial steady state in the long-run after the subsidy expires.



Notes: Parameter values: $\theta_m = 1$, $\alpha = 3$, $\delta = 0.9$, $\eta = 0.1$, $E = 100$, $k = 1.5$, $k_{subs} = 1.2$. $\theta^* = 3$. The initial unique steady-state of this economy is a LQE with $\mu = \overline{\theta} \approx 2.211$..

Figure 3.4: *Export Subsidy in a LQE*

subsidy, so that the increase in aggregate profits exceeds the tax cost of the subsidy. Hence, our model provides a new justification for export subsidies in countries exporting goods at the low end of the quality ladder.[27]

Figure 3.4 provides a numerical example of the economy's transition to its new, higher steady state in a case where the LQE is unique. It shows the transition dynamics for average quality, reputation, the thresholds θ_L and θ_H, as well as the number of active firms and

[27] In a setting where firms would set prices in a competitive way, we would have to balance this gain against the argument that an export subsidy tends to subsidize foreign consumers.

aggregate profits following an unanticipated permanent decline in k and assuming that all firms correctly anticipate the future path of μ. In the first period in which the subsidy is introduced, reputation is unchanged but the lower cost makes entry profitable for a larger range of firms. The gap (θ_L, θ_H) immediately narrows. The immediate net effect is a decline in average quality as the entry of low-quality firms dominates on impact for an unanticipated subsidy. However, over time as new cohorts of high-quality firms enter and decide to stay active, average quality $\overline{\theta}$ and reputation μ start rising, while θ_L further increases and θ_H keeps falling. μ adjusts to $\overline{\theta}$ with a lag, further encouraging entry and pushing up $\overline{\theta}$. This continues until reputation has caught up with actual quality and the economy has reached its new steady state.

3.5.1.2 Starting from a HQE

We have shown that an export subsidy enhances welfare in low-reputation exporting countries. Can the same policy be beneficial for a country that already exports high-quality goods? The next proposition states that instead of allowing a high-reputation country to move further up the quality ladder, a subsidy is actually detrimental to average quality and welfare in a high-quality equilibrium.

Proposition 9 *An export subsidy in a HQE lowers the steady-state average quality of exports and welfare of the exporting country.*

Proof: see Appendix C.1.8.

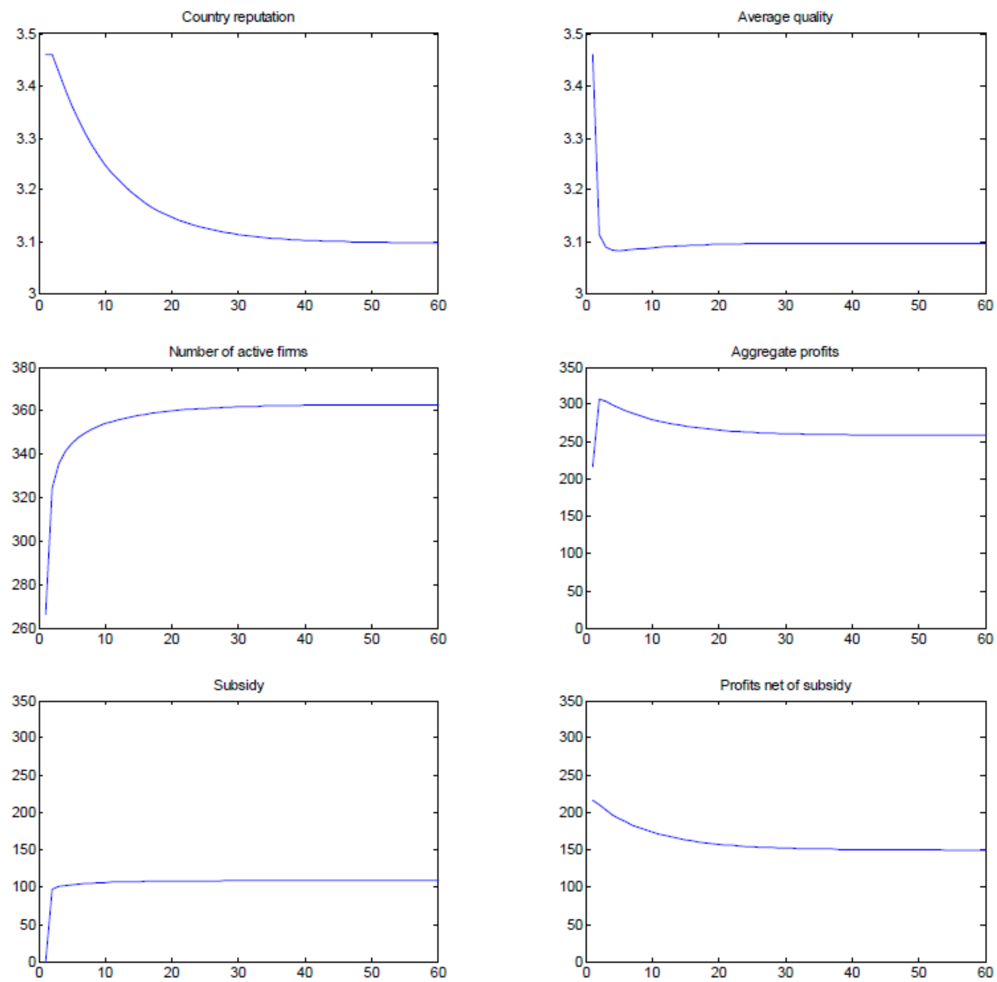
This result hinges on the changed exit patterns of high-quality versus low-quality firms. A decrease in k lowers θ^* and induces low-quality firms to stay longer. It does not change the incentives and decisions of high-quality firms. Hence, since average quality is initially above θ^*, the subsidy lowers actual mean quality: the number of low-quality firms increases while the number of high-quality firms remains unchanged.

This lower average quality, in turn, damages the country's reputation, which adjusts slowly to observed average quality. It has a negative effect on the profits of all active firms, all the more so as they have been active for a shorter time. Hence, the entry of lower-quality firms induced by the subsidy exerts a negative externality on all other active firms through its effect on national reputation. This externality explains why the overall increase in aggregate profits of all firms receiving the subsidy is not large enough to cover the cost of the policy, despite a higher volume of sales.

Intuitively, we can decompose the welfare effect into two components, respectively the effect on the intensive and extensive margin of profits. For the combination of quality and export experience for which firms are active both with and without the subsidy, the effect is unambiguously negative: they receive lower prices and the additional profits brought about by the subsidy are taken out of taxes. For the additional periods in which firms below θ^* stay in the market because of the subsidy, their profits fall short of the cost of the subsidy: otherwise, since the price is lower than in the absence of the policy, they would have been exporting without the subsidy. Therefore, the net effect is unambiguously negative.

Figure 3.5 shows an illustration of the transition to the new steady state. When the policy is introduced, low-quality firms immediately stay longer, leading to an increase in the number of active firms and a steep decline in average quality. National reputation then starts adjusting downwards until it reaches its new steady-state level. Aggregate profits first rise above their long-term value, because reputation remains "too high" during the adjustment period. Over time as μ falls and new cohorts of firms respond to the lower cost, the economy converges to a steady state with lower reputation and quality. As subsidies reduce firms' costs, aggregate profits are higher than in the initial equilibrium, but the increase in profits does not match the cost of the subsidy.

In a nutshell, in a HQE, a subsidy to the fixed cost k actually lowers average quality by promoting entry of low-quality firms. Overall, the desirability of an export subsidy depends on the tradeoff between encouraging entry by high-quality firms which are deterred by the cost of establishing a reputation, and inducing entry by low-quality fly-by-nights.



Notes: Parameter values: $\theta_m = 1$, $\alpha = 2$, $\delta = 0.9$, $\eta = 0.1$, $E = 100$, $k = 1.5$, $k_{subs} = 1.2$. $\theta^* = 3$. The initial unique steady state of this economy is a HQE with $\mu = \overline{\theta} \approx 3.461$.

Figure 3.5: *Export Subsidy in a HQE*

3.5.2 Export Promotion Campaign and Reputation Shocks

An export promotion campaign is an effort to promote the quality of foreign goods in Home, e.g. through advertisements by export promotion agencies or exporters' associations, or by hosting "mega-events" to showcase the country – as we mentioned, the Olympics in Seoul in 1988 and in Beijing in 2008 were explicitly assigned this goal by government officials. We model it as a one-shot increase in the national image μ_t from the initial steady-state, absent any changes in the underlying quality distribution of firms. More generally, the analysis below applies to reputation shocks not driven by changes in the quality distribution. We focus on situations in which the economy is initially in a stable low-quality equilibrium.

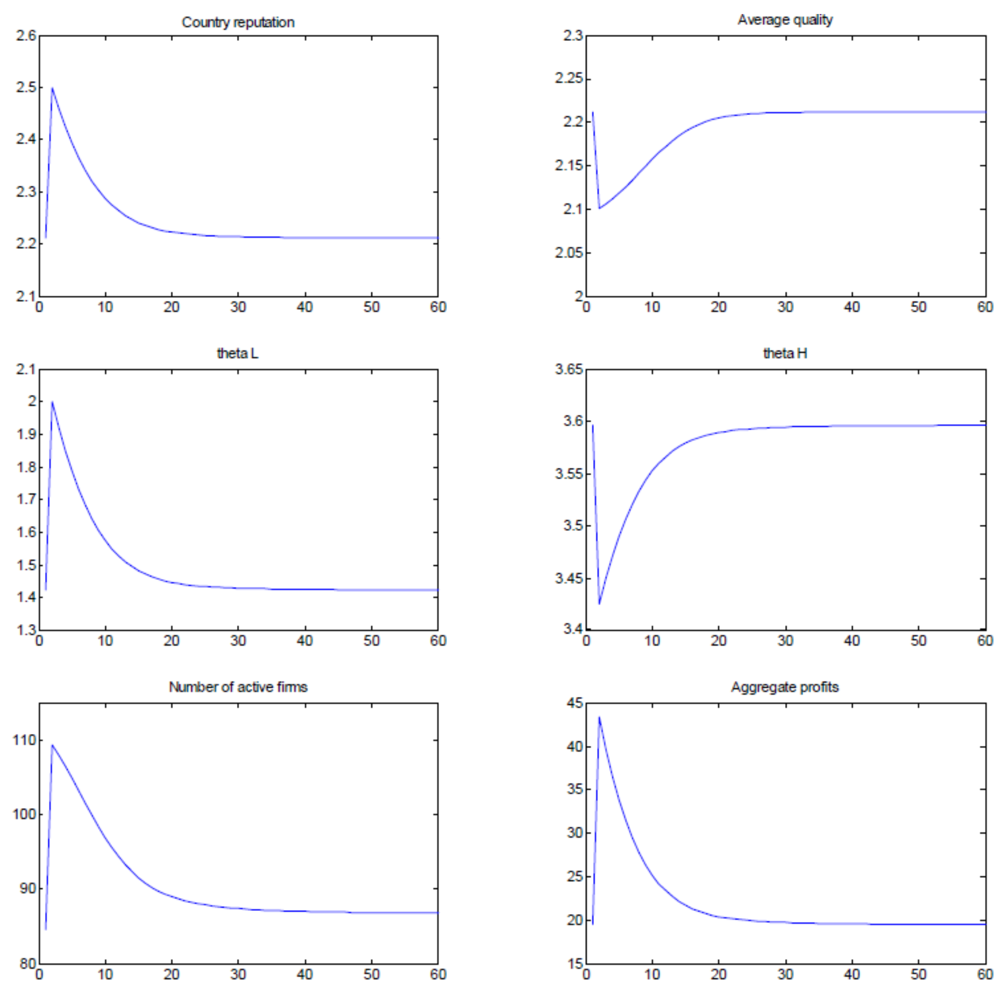
3.5.2.1 Unique Steady State

If the economy has only one long-run equilibrium, it must return to this steady state in the long run. The export promotion campaign only has short-run effects on the distribution of quality. Figure 3.6 provides an example of the transition dynamics associated with a positive shock. An export promotion campaign results in a one-shot increase in national reputation μ_t, starting from the steady state.

The initial jump in reputation fosters entry by firms in segments of the quality distribution where they were previously inactive: θ_H decreases and θ_L increases. The net effect of the entry response is a drop in average quality $\overline{\theta}$ immediately after the shock occurs. Thus, the gap between actual and perceived average quality leads national reputation to adjust downwards in the following periods. As the country's reputation moves back down, the range of qualities for which entrants choose to stay inactive widens again, driving average quality back up until it has reverted to its original steady-state value, along with reputation. There are no long-run effects.

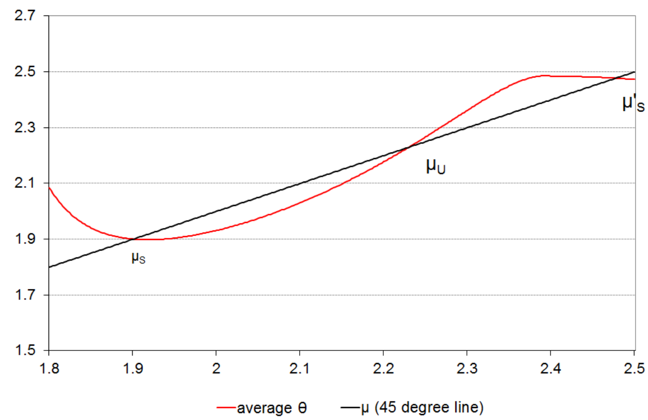
3.5.2.2 Multiple Steady States

If the economy has multiple steady states, there are several low-quality equilibria. Figure 3.7 provides an illustration of this case. Assume the country starts in a stable LQE μ_S. If



Notes: Parameter values identical to Figure 3.4. μ_t rises exogenously to 2.5 at $t = 1$.

Figure 3.6: *Positive Reputation Shock with a Unique LQE*



Notes: Parameter values: $\theta_m = 1$, $\alpha = 2.2$, $\delta = 0.7$, $\eta = 0.1$, $E = 100$, $k = 1.2$. $\theta^* = 2.4$. The steadystates of this economy are $\mu_S \approx 1.900$, $\mu_U \approx 2.230$ and $\mu'_S \approx 2.477$.

Figure 3.7: *Multiple Equilibria*

there are no steady states with higher reputation than μ_S, an export promotion campaign has the same effects as when the steady state is unique.

If there exists a steady state $\mu > \mu_S$, there must be an even number of steady states with $\mu > \mu_S$. Let us define $\mu_U > \mu_S$ such that μ_U is a steady state and for all $\mu_S < \mu < \mu_U$, μ is not a steady state. Similarly, define $\mu'_S > \mu_U$ such that μ'_S is a steady state and for all $\mu_U < \mu < \mu'_S$, μ is not a steady state. μ_U is unstable and μ'_S is stable.

Starting in μ_S, a "small" promotion campaign moves national reputation to a level μ_t such that $\mu_S < \mu_t < \mu_U$. The impact of a small campaign is similar to the case with a unique equilibrium: in the long run, the economy returns to μ_S. A "large" promotion campaign moves national reputation to $\mu_t > \mu_U$. Then, the resulting entry by firms below the initial θ_H and above the initial θ_L leads to an increase in average quality, magnifying the shock. Actual quality follows reputation in a self-fulfilling manner. Quality and reputation keep rising until the economy settles in the more favorable steady-state μ'_S. In the example of Figure 3.7, μ'_S is a high-quality equilibrium. These results are summarized in Proposition 10.

Proposition 10 *Positive reputation shocks*

(i) Starting from a unique LQE or from a LQE that has the highest μ among steady states, a one-time positive shock to national reputation μ_t increases aggregate profits and decreases average

quality in the short-run, and has no effect in the long-run.

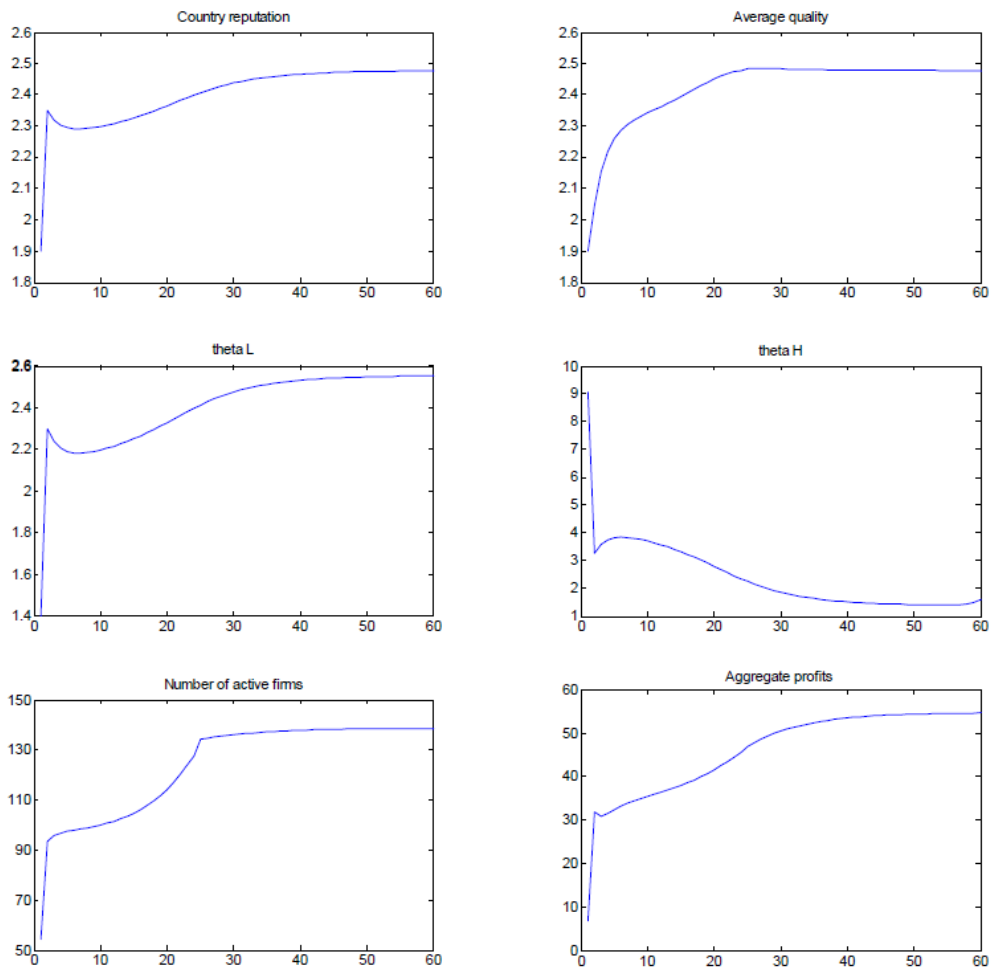
(ii) Starting from a stable LQE μ_S such that there exist other steady states above μ_S, a small one-time positive shock ($\mu_t < \mu_U$ as defined above) to national reputation increases aggregate profits and may increase or decrease average quality in the short-run, and has no effect in the long-run.

(iii) Starting from a stable LQE μ_S such that there exist other steady states above μ_S, a large one-time positive shock ($\mu_t > \mu_U$ as defined above) to national reputation increases aggregate profits and average quality both in the short-run and in the long-run.

Proof: see Appendix C.1.9.

Figure 3.8 illustrates the transition to the new steady state. With the parameter values of Figure 3.7, the economy starts in the LQE μ_S and the unanticipated one-shot policy at time 1 results in a jump of the country reputation above μ_U. Following the large shock, the economy moves to the HQE μ'_S. Note that the policy is not anticipated prior to time 1, but once the shock is realized, we assume that all firms have correct expectations of the subsequent path of μ. The immediate effect of the shock is to boost expected profits for all firms, fostering entry by a range of firms that did not export in the initial steady state. For a large shock as defined in Proposition 10, the net effect of additional entry around θ_L and θ_H is to raise average quality, sufficiently so to ensure that reputation in the next period remains above μ_U. As the policy was not anticipated by high-quality firms in the previous periods, μ falls in the immediate aftermath of the shock. Reputation rises thereafter as new cohorts of high-quality firms decide to enter and stay active, until the economy settles in the new steady state μ'_S with higher quality and higher aggregate profits.

To sum up, a policy which brings about a positive shock to national reputation has only short-lived effects on the quality distribution of exporters and on aggregate profits in a unique steady state or if the shock is small. However, a large shock starting from a low-reputation, low-quality equilibrium is self-fulfilling when the economy has multiple steady states. It encourages entry by high-quality firms. In the segments of the average quality-reputation function where entry by high-quality firms drives up quality more than entry by lower-quality firms drives it down, a one-shot increase in reputation brings about



Notes: Parameter values identical to Figure 3.7. μ_t rises exogenously to 2.35 at $t = 1$.

Figure 3.8: *Large Positive Reputation Shock with Multiple Equilibria*

a permanent increase in quality, profits and welfare. To be successful in the long-run, an export promotion campaign based solely on improving the country's brand image must therefore induce a large jump in beliefs. A negative reputation shock has the opposite effects, as stated in Corollary 1.

Corollary 1 *Negative reputation shocks*

(i) Starting from a unique LQE or from a LQE that has the lowest μ among steady states, a one-time negative shock to national reputation μ_t reduces aggregate profits and increases average quality in the short-run, and has no effect in the long-run.

(ii) Starting from a stable LQE μ'_S such that there exist other steady states below μ'_S, a small one-time negative shock ($\mu_t > \mu_U$ as defined above) to national reputation reduces aggregate profits and may increase or decrease average quality in the short-run, and has no effect in the long-run.

(iii) Starting from a stable LQE μ'_S such that there exists other steady states below μ'_S, a large one-time negative shock ($\mu_t < \mu_U$ as defined above) to national reputation reduces aggregate profits and average quality both in the short-run and in the long-run.

This last result implies that there can be long-term consequences of a sudden large drop in reputation, which moves a country to a less desirable steady-state equilibrium. In particular, large product recalls or heavily mediatized consumer safety scandals concerning exports of one country can permanently affect the structure of its industry, lowering both quality and reputation in the long-run.[28]

Lastly, a policy instrument we have not dwelled on is quality standards. It might seem that imposing a quality certification requirement, if the testing process is not too costly, would be a desirable policy as it reduces asymmetric information concerns. This holds true in a purely domestic setting when consumer welfare comes into play. The policy maker

[28]Chisik (2003) provides an example of such a negative reputation shock in the Colombian garment industry: *"Although expanding at a rapid rate throughout the early 1970s Colombia's deteriorating reputation became a determining factor in the contraction of this industry. Much of this demise can be attributed to a single Colombian garment firm that took a contract (for 50,000 men's suits) that was beyond their capability. The poor-quality result so tarnished the American importer's name that other high-quality importers became wary of Colombian-sewn garments. With the payoff to high-quality production reduced, Colombian garment firms then concentrated on low-quality markets, and the newly-found unfavorable reputation was justified."*

would then choose where to set the bar by weighing improved reputation and consumer surplus against the costs of testing and profits forgone by firms that do not meet the standard. However, as regards exports, setting minimum quality standards does not yield a clear-cut welfare improvement and may actually result in welfare losses for the exporting country. The intuition behind this result is simple. On the one hand, a minimum quality standard means that the "made in" label is a better quality signal. It raises the country's reputation and prices received by all firms that meet the standard. On the other hand, firms below the threshold are forced to shut down. As the foreign consumers' welfare is not taken into account, this lowers the country's welfare: the profits received by "fly-by-night" low-quality firms at the expense of foreign consumers are forgone. As a result, such a policy only improves welfare in our model under specific assumptions regarding in particular the shape of the quality distribution. Hence, it is not the case in general that a quality standard (even one that is costless to enforce) benefits the exporter.

3.6 Conclusion

We have shown that when consumers are not fully informed about the quality of what they buy, national reputation matters for exporters. For new firms without established brand names, the inability to reveal quality to consumers before purchase distorts the incentives to enter export markets. Low-quality firms rely on the national brand, while high-quality firms suffer from it. This framework helps explain the high observed turnover rate among new exporters and a "brand premium" whereby incumbents receive higher unit prices than entrants.

More broadly, unobservable quality tilts the long-run quality composition of an export-oriented industry towards its low end, all the more so as the exporting economy has a poor reputation for quality in the importing country. In that respect, reputation has self-perpetuating features since future national reputation adjusts to past exports quality. These issues are particularly relevant for developing countries trying to grow into exporting increasingly sophisticated goods. National reputations create history dependence in the range of goods a country can successfully export. A damaged national reputation is a barrier to entry for companies that develop more expensive high-quality products, threatening the success of such a growth strategy. To overcome the adverse aggregate effects of asymmetric information, the optimal policy critically depends on whether the country's initial equilibrium is a high-quality or a low-quality one. In cases with low initial reputation, we find that policies that lower the cost of exporting can lead to a welfare gain by improving the country's long-run average quality and reputation. We also show that policies inducing a positive jump in consumer beliefs can have self-fulfilling effects on the quality of exports if the shock is sufficiently large, but have no long-run effects if the shock is small. Export subsidies are, however, detrimental to both reputation and welfare in countries already exporting high-quality products, as they encourage the entry of "fly-by-night" unreliable firms.

This paper opens the way for new research in several directions. We have developed a model with reduced-form import demand, abstracting from the determinants of demand for domestic versus foreign goods. We could explore further the conditions under which developing countries end up specializing in low-quality exports by introducing within-sector competition between domestic and foreign firms and non-homothetic preferences for quality. Both country reputations and the sensitivity of host market consumers to quality will be determinants of within-industry specialization across countries. Specifically, as long as the elasticity of demand to perceived quality rises with income, we expect that asymmetric information concerns will affect exports from developing countries to advanced countries more than to other developing countries. Hence, the relative force of factor-driven comparative advantage and "reputational comparative advantage" will shape export patterns differently both in more versus less differentiated industries and towards high-versus low-income destination markets.

Regarding policy responses, we have focused on country-level economic and trade policies, designed to enhance the position of a country's exports along the quality ladder. Going further, our analysis provides a framework for a richer understanding of firms' sourcing decisions through the lens of a strategic use of "made in" rules. Exporters can find it optimal to resort to original equipment manufacturers or depart from the cost-minimizing way of splitting the production process across locations, in order to obtain a favorable country-of-origin denomination. The location of manufacturing and assembly will be decided not only according to cost considerations, but also depending on the regulations surrounding rules of origin, consumer sensitivity to quality, and the degree of asymmetric information in the industry. An extension of our model along these lines would generate testable predictions at the firm level. These topics will be investigated in future research.

Chapter 4

Price Discrimination in a Two-Sided Market: Theory and Evidence from the Newspaper Industry[1]

4.1 Introduction

The newspaper industry is a canonical example of a two-sided market: newspapers serve two distinct groups of consumers – readers and advertisers, where each group cares about the presence and characteristics of the other. The resulting network effects lead to subtle pricing policies that have received much attention recently (see for instance Rochet and Tirole (2003) and Weyl (2010)). One feature of newspapers' pricing policies is the observed price discrimination between subscribers and occasional buyers; subscribers are typically charged a lower per issue price than occasional buyers, and these price differences appear not to be explained by cost differences entirely. Furthermore, this difference in prices has recently increased and newspapers tend now to favor a more subscriber-based readership; a tendency which is often interpreted as a response to the industry's state of distress, itself in part attributed to the continuing drop in adverting revenues.

[1]Co-authored with Charles Angelucci and Romain de Nijs

In this paper we investigate how the reliance on advertising revenues interacts with the incentives newspapers have to adopt subscriber-based readerships. To this end, we first extend recent models of multi-sided industries to incorporate the scope for second-degree price discrimination between subscribers and occasional buyers and, second, we carry out an empirical analysis using a new dataset on the French local newspaper industry that we build from archives data.

We build a general model of a two-sided market in which a monopolist newspaper repeatedly interacts with a continuum of readers and a continuum of advertisers. Newspapers can be purchased by readers either by subscription or at the newsstand on a day-by-day basis. Independently of the presence of advertisers, the scope for price discrimination stems from (i) the readers' uncertainty regarding their exact willingness to pay in future periods and (ii) the readers' heterogeneity in their average willingness to pay. Readers with a high average willingness to pay subscribe at a low per unit price, while others buy the newspaper at a high price whenever their willingness to pay is high.[2]

Advertisers are heterogenous in (i) their taste for subscribers, (ii) their taste for occasional readers, and (iii) their outside option (i.e., their payoff when placing ads on alternative platforms). The challenge is to disentangle how the presence of advertisers affects the prices charged to readers. We characterize the optimal pricing formulas of the newspaper, as well as the readers and advertisers' demands. These formulas are intuitive and in the spirit of Weyl (2010). When choosing its prices, aside from taking into account the various marginal costs and demand elasticities, the newspaper must cater to (i) the average taste of marginal readers – those indifferent between subscribing or buying occasionally on the one hand, and those indifferent between buying occasionally or never on the other – and (ii) the average taste of marginal advertisers for both subscribers and non subscribers, as well as their outside options.

We also aim at providing some comparative statics. We are particularly interested in

[2]This rationale for price discrimination was first introduced by Glazer and Hassin (1982), but in a model without advertisers.

the impact on the extent of price discrimination of an increase in the outside option of advertisers. In a simplified model we show that such a shock leads to an increase in the prices charged to readers. Indeed, since less surplus may be extracted from advertisers – and assuming that advertisers prefer more eyeballs to less – the newspaper will cater less to the advertisers' taste for large readerships and instead increase its margin on the readers' side (as empirically observed in Seamans and Zhu (2012)). On the other hand, whether the newspaper moves towards a more subscriber-based readership is a priori unclear as it depends also on the average profile of the newly relevant marginal advertisers (and in particular their average taste for subscribers versus non subscribers).

On the empirical side, the main empirical challenge is to isolate the "advertising revenue" effect on price discrimination. To this end, we follow an empirical strategy in the spirit of an event study. We exploit the introduction of advertisement on French Television in October 1968 by treating it as an exogenous negative shock on the advertising side of newspapers. Television is state-owned in France from 1945 to 1981. The introduction of advertisement on television is decided by law, despite strong resistances by the newspaper industry. This introduction leads to an exogenous shock that shifts exclusively the incentives to price discriminate stemming from advertising revenues. Indeed, reader heterogeneity and the various marginal costs of producing and delivering newspapers are not affected. To the best of our knowledge, we are the first to use this "quasi-natural" experiment.

Our identifying assumption is that the negative shock on advertising revenues has affected national daily newspapers, but not local daily newspapers. Indeed, while national newspaper advertising consists mostly of commercial ads that are relatively close substitutes to those broadcasted on television (national brands, etc), a large share of advertising in local newspapers is instead local in nature (local commercial ads and classified ads). We thus use national newspapers as our "treated group", and local newspapers as our "control group". Using novel annual data on local and national newspapers between 1960 and 1974, we compare the pre-1968-to-post-1968 change in price discrimination by national daily newspapers to the change in price discrimination by local daily newspapers over the same period (Difference-in-Difference estimation). We find that the decrease in advertising revenues leads to an increase in the extent of price discrimination, i.e., newspapers adopt a more subscriber-based readership as a consequence to the drop in advertising revenues. Our results are robust to a range of alternative specifications and controls. In particular, they are robust to controlling for industry-specific time trends, and to allowing for flexible time-varying effects of the negative shock on advertisement revenues (Laporte and Windmeijer, 2005).

Literature review This paper first contributes to the empirical literature that examines the determinants of price discrimination. A growing number of papers investigate the role of competition. Seminal contributions include Borenstein (1991) on retail gasoline markets and Borenstein and Rose (1994) on airline tickets. More recent articles include Busse and Rysman (2005) who investigate pricing in Yellow pages advertising, Gerardi and Shapiro (2009) who reexamine air ticket price discrimination, Dai *et al.* (2012) who study the non-monotonicity of the effect of competition on price discrimination using data from the U.S. airline, and Seim and Viard (2011) who study nonlinear pricing in cellular telecommunication markets. This paper also aims at contributing to the growing body of research on price discrimination that uses structural analysis approaches (McManus, 2007). All theses articles study one-sided markets, while ours aims at understanding the consequences of network effects on price discrimination.

There also exists a very recent vein of research that examines the role of consumers' bounded rationality on price discrimination via subscription (see Grubb (2012) for an insightful review). Prominent contributions to this literature are DellaVigna and Malmendier (2004) for contracts in health sport centers and Grubb (2009) for cellular phone service plans. Although we recognize that bounded rationality may play a role in consumers' decision as to subscribe or not to a newspaper, the scope for price discrimination in our model instead stems from informational considerations. In addition, our aggregated data do not allow us to investigate this issue. Finally Clerides (2004) discusses the definition of price discrimination when products are differentiated. This is of particular importance to us. Indeed, we are considering here identical newspapers but whose cost of production – through the cost of delivery – can vary depending on whether the reader is a unit buyer buying in a newsstand or a subscriber. We show that at least part of the price differences we observe cannot be explained by delivery cost differences. Our paper builds more specifically on Glazer and Hassin (1982) who first study price discrimination by a newspapers based on consumers uncertainty. We introduce the advertising side in the profit function of the newspapers and discuss how this aspect modifies prices on the reader side.

Our paper also relates to the literature on two-sided markets. To the best of our knowledge, Liu and Serfes (2010) is the only paper investigating price discrimination in two-sided markets. However, their modeling approach does not fit well with the newspaper industry as they consider perfect price discrimination on both sides in a Hotelling framework. Our paper is closely related to several seminal papers on two-sided markets (without price discrimination). Rochet and Tirole (2003) provide a widely applicable model of two-sided markets and discuss markets for advertising, credit cards, software and web portal usage. Weyl (2010) and White and Weyl (2010) further extend two-sided market models. We contribute to this recent line of research by introducing second-degree price discrimination on one side of the market. Anderson and Coate (2000) study broadcast markets in which retailers pay for advertising to reach consumers, and where consumers dislike advertising. Rysman (2004) provides an empirical analysis of the market for yellow pages. Further, Seamans and Zhu (2012) look at the impact of the entry of Craig's list on local newspapers' pricing policies. They find that this negative shock on the advertisement side of newspapers had led to an increase in subscription prices. Jin and Rysman (2013) study US sports card conventions pricing though the lens of the two-sided market theory. Finally, Fan (2013) endogenizes newspapers quality in a discrete choice model to better asses merger effects. Naturally, much work on two-sided markets has focused on the Media Industry. Berry and Waldfogel (1999) for instance analyze the effects of entry by radio stations. Argentesi and Filistrucchi (2007) develop an analysis to estimate market power in two-sided markets. While they also consider the newspaper industry (Italy), they do not focus their attention on second-degree price discrimination as they lack data on subscription prices. Finally, their period of interest (1976-2003) is longer than ours, but our sample of newspaper is significantly larger. There is also a line of research investigating whether consumers of Media like/dislike advertising (it is typically assumed in theoretical analyses that consumers dislike advertising). Kaiser and Song (2009) for instance use data on German consumer magazines (between 1992 and 2004) to analyze the extent to which consumers (dis-)like advertising.

Finally, this research project is a contribution to the empirical literature on media using historical data to understand the evolution of the newspaper industry and its impact on society. In a paper investigating the effect of newspapers entry and exit, Gentzkow *et al.* (2011) find that newspapers have a robust positive effect on political participation in the United States. In the first chapter of this dissertation, I instead show that increased competition may have a negative effect on participation. In their recent work on competition and ideological diversity Gentzkow *et al.* (2012) estimate a model of newspaper demand, entry, and political affiliation choice, in which newspapers compete for both readers and advertisers.

The remainder of the paper is organized as follows. Section 4.2 develops a model of second-degree price discrimination by a platform. In Section 4.3, we present historical background on the introduction of advertisement on French Television in 1968, and then describe the new dataset we built for this study. In Section 4.4 we estimate the effect of the advertising side of newspapers on price discrimination on the reader side using a Differences-in-Differences analysis based on the introduction of advertisement on French Television. Section 4.5 concludes.

4.2 A Model of Second-Degree Price Discrimination by a Platform

4.2.1 Set-up

To model the newspaper industry we consider the repeated interaction between a newspaper, a continuum of readers of mass one (side R of the industry), and a continuum of advertisers of mass one (side A). In the following we denote S the subgroup of readers subscribing to the newspaper, and K the subgroup of occasional buyers (where K stands for "Kiosk"). The newspaper sells n issues during the length of the period of interest, which we take as given.

Newspaper The profit-maximizing newspaper chooses (i) which price p to charge occasional unit buyers, (ii) which price nh to charge subscribers to have the newspaper delivered to their home for the n issues and (iii) which price nt to charge advertisers to have their ad be placed for n issues. The marginal cost of serving unit buyers is denoted c_K, that of serving subscribers is c_N, and, finally, that of serving advertisers is c_A. We do not model the actual production of news, and thus implicitly assume that the newspaper produces content that is of interest to at least some readers.

Readers The gross payoff to reader i from reading the newspaper at date t is given by:

$$U_{i,t} = \theta_i + \epsilon_t, \tag{4.1}$$

where θ_i represents an individual specific taste for reading, while ϵ_t captures a common shock to all readers at date t (say elections, sport events, etc).[3] We assume that θ has support going from minus infinity to plus infinity, and is drawn according to $f^R(\theta)$. Furthermore, ϵ_t takes value x with probability $\frac{1}{2}$, and zero otherwise. Reader i, if she has not subscribed, observes the realization of ϵ *before* deciding whether to purchase the newspaper at date t. Not subscribing thus allows readers to make informed purchasing decisions.

[3]We thus disregard externalities stemming from the presence of ads.

For a given subscription price h per issue (i.e., the actual subscription price is nh), and prior to observing the n future realizations of ϵ, reader i's expected utility from subscribing is:

$$U^S(\theta_i, h, n) = n\left(\theta_i + \frac{x}{2} - h\right). \tag{4.2}$$

The subscriber pays nh *upfront* to have the n issues delivered at home, and thus read all n issues (since $x > 0$ by assumption), where the expected gross benefit per issue is $\theta_i + \frac{x}{2}$.

A reader i's expected utility from occasionally buying the newspaper at the newsstand price p per issue is instead given by is:

$$U^K = \begin{cases} n\left(\theta_i + \frac{x}{2} - p\right), & \text{if } \theta_i \geq p \\ \frac{n}{2}\left(\theta_i + x - p\right), & \text{if } p > \theta_i \geq p - x \\ 0, & \text{if } p - x > \theta_i \end{cases} \tag{4.3}$$

Recall first that non-subscribers make their purchasing decisions at date t knowing the realization of ϵ_t. Readers that have a very high taste for reading (that is, readers for which $\theta_i \geq p$) always buy the newspaper; their expected gross benefit per issue is thus again $\theta_i + \frac{x}{2}$. Buyers with instead an intermediary taste for reading (that is, readers for which $p > \theta_i \geq p - x$) only buy the newspaper when the shock ϵ_t is positive (i.e., when $\epsilon_t = x$). The expected number of purchases made by these readers is thus $\frac{n}{2}$; and their gross payoff when the shock is positive is equal to $\theta_i + x$. Finally, readers with a very low taste for reading never buy the newspaper.

Advertisers We assume that advertisers choose between either placing an ad in the newspaper for n periods at price nt or never placing an ad. The gross payoff to advertiser j of placing an add for n periods is taken to be $V_j = nb_j^S N^S + nb_j^K N^K$, where b_j^S captures advertiser j's taste for the average number of subscribers per period N^S, while b_j^K captures his taste for the average number of non-subscribers per period N^K. In addition, advertiser j has outside option $n\alpha v_j$. The 3-tuple (b_j^S, b_j^K, v_j) is drawn according to the joint pdf $f^A(b^S, b^K, v)$, where each parameter is drawn from support going from minus infinity to plus infinity.

We assume away any price discrimination by the newspaper on the advertisers' side of the industry (i.e., all advertisers face price nt).

We thus have that advertiser j places an ad in the newspaper for n issues at unit price t if and only if:

$$V_j = nb_j^S N^S + nb_j^K N^K - nt \geq n\alpha v_j. \tag{4.4}$$

One can already anticipate that the advertisers' taste for large readerships may induce the newspaper to set prices "artificially" low on side R so as to attract many readers (i.e., more than in a world without advertisement) and in turn charge high prices to advertisers. If prices charged to readers are below the relevant marginal costs, advertisers *de facto* subsidize readers. The parameter α captures the supply of alternative platforms to advertisers. These alternative platforms could be other newspapers (therefore treated in a reduced form) or, in the spirit of this paper, the television. It is reasonable to think that the introduction of advertisement on television leads to an increase in α.

4.2.2 Solving the Model

We first compute the three relevant demand functions; that is, the demand for subscriptions, the average demand per issue of newspapers at the newsstand, and the demand for advertising slots.

Readers As long as $p > h$, when comparing payoffs (4.3) and (4.2), one derives that high-valuation readers subscribe and average ones instead buy occasionally.[4] In particular, the demand by subscribers is equal to:

$$N^S = \int_{2h-p}^{\infty} f^R(\theta) d\theta. \tag{4.5}$$

[4]Observe that it is weakly suboptimal for the newspaper to set $p < h$ (and having no readers subscribe) since the same outcome can be guaranteed by setting $p = h$. Furthermore, we implicitly assume that it is in fact optimal to set $p > h$. In the simplified model we provide in Subsection 4.2.3, we provide a condition such that this is indeed the case.

Rather intuitively, more readers are willing to subscribe to the newspaper when the subscription price nh decreases and/or the unit price p increases. The demand by unit buyers is instead given by:

$$N^K = \int_{p-x}^{2h-p} f^R(\theta)d\theta, \tag{4.6}$$

which is decreasing in the unit price p but increasing in the subscription price nh.

Readers with a high taste for reading would buy every issue of the newspaper at the newsstand at price p (even when $\epsilon_t = 0$) if subscribing was not possible. Since subscribing is instead possible, and since $h < p$, these readers prefer subscribing to enjoy the lower average price. Readers with an average taste for reading instead have a low-enough gross payoff when $\epsilon_t = 0$ that it is not interesting for them to have all n issues be delivered to their home; they prefer buying it only when $\epsilon_t = x$, even though the per-issue price p is higher. Here lies the scope for price discrimination. Setting $h < p$ means extracting less surplus from the readers with a rather high taste for reading (those who would have bought the newspaper at the newsstand anyway), but allows the platform to extract more surplus from the informed consumers; i.e., those who buy only when $\epsilon_t = x$. It is thus these informational differences that the newspaper exploits through second-degree price discrimination. In other words, it is not the presence of advertisers that explains the existence of price discrimination in this model; though advertisers will certainly affect its extent.

Advertisers On the other side of the industry, the demand by advertisers is given by:

$$N^A(N^S, N^K, t, \alpha) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\frac{1}{\alpha}\left(b^S N^S + b^K N^K - t\right)} f(b^S, b^K, v)dvdb^S db^K, . \tag{4.7}$$

Advertisers are more willing to place their ads in the newspaper as the average number of readers increases (both subscribers and non-subscribers), as the price of advertising nt decreases, and as their outside option decreases. The pricing policy of the newspaper must thus take into account these *network effects* when choosing prices on the readers' side.

The newspaper's problem Having characterized the relevant demands, the newspaper's profits are equal to:

$$\Pi = \Pi^S + \Pi^K + \Pi^A \tag{4.8}$$
$$= \frac{n}{2}\left(p - c^K\right) N^K(h,t) + n\left(h - c^S\right) N^S(h,t) + n\left(t - c^A\right) N^A\left(N^S, N^K, t, \alpha\right)$$

The newspaper chooses h, p, and t to maximize (4.8). In the following proposition let ϵ_h^S denote the elasticity of the subscribers' demand with respect to the subscription price h, ϵ_h^K that of the unit buyers' demand with respect to the unit price p, etc.

Proposition 1 *The optimal pricing policy of the newspaper is characterized by the following three pricing formulas:*

$$\frac{h - c^S}{h} = -\frac{1}{\epsilon_h^S} - \frac{1}{2}\left(p - c^k\right)\frac{\partial N^K}{\partial h}\frac{1}{N^S}\frac{1}{\epsilon_h^S} - \left(t - c^A\right)\frac{\partial N^A}{\partial h}\frac{1}{N^S}\frac{1}{\epsilon_h^S} \tag{4.9}$$

$$\frac{p - c^K}{p} = -\frac{1}{\epsilon_p^K} - 2\left(h - c^S\right)\frac{\partial N^S}{\partial p}\frac{1}{N^K}\frac{1}{\epsilon_p^K} - 2\left(t - c^A\right)\frac{\partial N^A}{\partial p}\frac{1}{N^K}\frac{1}{\epsilon_p^K} \tag{4.10}$$

$$\frac{t - c^A}{t} = -\frac{1}{\epsilon_t^A}. \tag{4.11}$$

Proof Differentiating (4.8) with respect to h yields:

$$N^S + \left(h - c^S\right)\frac{\partial N^S}{\partial h} + \frac{1}{2}\left(p - c^K\right)\frac{\partial N^K}{\partial h} + \left(t - c^A\right)\frac{\partial N^A}{\partial h} = 0, \tag{4.12}$$

where

$$\frac{\partial N^A}{\partial h} = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f\left(b^S, b^K, \frac{1}{\alpha}\left(b^S N^S + b^K N^K - t\right)\right)\left(\frac{1}{\alpha}\left(b^S\frac{\partial N^S}{\partial h} + b^K\frac{\partial N^K}{\partial h}\right)\right) db^S db^K.$$

Note that this is nothing else than the average marginal change in payoff of the marginal advertisers (those exactly indifferent between placing an ad or not). One may rewrite (4.12) as follows:

$$h = c^S \frac{\epsilon_h^S}{1+\epsilon_h^S} - \frac{1}{2}\left(p - c^K\right)\frac{\epsilon_h^K}{1+\epsilon_h^S}\frac{N^K}{N^S} - \left(t - c^A\right)\frac{\epsilon_h^A}{1+\epsilon_h^S}\frac{N^A}{N^S}.$$

Similarly, differentiating (4.8) with respect to p and rearranging yields (4.10), while differentiating (4.8) with respect to t yields (4.11). ■

Intuition These pricing formulas are Lerner pricing formulas modified to take into account the scope for price discrimination within readers as well as the presence of advertisers. These pricing formulas, as well as the three demand functions, help us gain a good intuition for the newspaper's prices. In addition to taking into account the various marginal costs and elasticities, the newspaper chooses its prices on the readers' side taking into account (i) the average marginal change due to a change in prices charged to readers in the payoff of the marginal advertisers (those indifferent between placing an ad or not), as well as (ii) the incentives for non-subscribers to become unit buyers, and finally the incentives for non-subscribers to stop purchasing altogether. Not surprisingly, we also observe that the relative sizes of each group of consumers matters as well. Finally, note that the formula for the advertising price is nothing else but the standard Lerner pricing formula (since externalities from advertising on readers are for now disregarded).

In addition to this, these formulas also offer us insights directly linked to the empirical analysis carried out in this paper. Note first that

$$\frac{\partial N^A}{\partial h} = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f\left(b^S, b^K, \frac{1}{\alpha}\left(b^S N^S + b^K N^K - t\right)\right)\left(\frac{1}{\alpha}\left(b^S \frac{\partial N^S}{\partial h} + b^K \frac{\partial N^K}{\partial h}\right)\right) db^S db^K$$

is equal to the average marginal change in payoff of the marginal advertisers (those exactly indifferent between placing an ad or not), scaled by the common component of their outside option. This implies that an increase in the outside option following, say, the introduction of advertisement on television, affects the *extent* of price discrimination through a *composition effect*, i.e., through a change in the average "type" of marginal advertisers. The second effect is, in a sense, less subtle: a change in the outside option of advertisers also changes the price the newspaper can charge them (it decreases it). Because of this effect, all else equal, the newspaper will distort less the prices charged to readers. Finally, the magnitude of these two effects is affected by the relative sizes of the groups of subscribers and non-subscribers (as well as the absolute value of their own price elasticity of demand.)

4.2.3 A Simple Model

The main virtue of the general framework presented in the previous subsection is to identify the relevant economic factors that determine a newspaper's pricing policy. To gain further intuition, and to carry out comparative statics, we however simplify the framework presented so far in several ways. We first suppose that $\theta_i \sim U\left[0, \overline{\theta}\right]$. This implies that the revenues from subscribers become:

$$\Pi^S = nh\left(\frac{\overline{\theta} - (2h - p)}{\overline{\theta}}\right), \tag{4.13}$$

while those from unit purchases are instead given by:

$$\Pi^K = \frac{np}{2}\left(\frac{(2h - p) - (p - x)}{\overline{\theta}}\right) = \frac{np}{\overline{\theta}}\left(h - p + \frac{x}{2}\right). \tag{4.14}$$

Next we further simplify the framework by assuming that all advertisers care about is *the average number of readers per issue*, i.e., $V_j = nN^R$, where $N^R = \frac{\overline{\theta} - \left(h - \frac{x}{2}\right)}{\overline{\theta}}$.

In addition, let the newspaper engage in perfect price discrimination on the advertisers' side, i.e., let the newspaper choose advertising price nt_j for advertiser j.

Advertiser j has outside option $\alpha v_{0,j}$, where $v_{0,j} \sim U\left[0, \overline{V}\right]$, and thus places an ad if and only if:

$$nN^R - nt_j \geq n\alpha V_{0,j}. \tag{4.15}$$

Again, $v_{0,j}$ captures advertiser j's payoff on alternative platforms, and α captures the supply of these alternative platforms. The advertising revenue is thus equal to:

$$\Pi^A = n\int_0^V \max\left[N^R - \alpha V_{0,j}, 0\right] dj$$

$$= n\frac{(N^r)^2}{2\overline{V}\alpha}$$

The newspaper therefore chooses p and h to maximize expected payoff:

$$\Pi = \Pi^S + \Pi^K + \Pi^A = ns\left(\frac{\overline{\theta} - (2h-p)}{\overline{\theta}}\right) + np\left(\frac{h - p + \frac{x}{2}}{\overline{\theta}}\right) + n\frac{(N^R)^2}{2\overline{V}\alpha}. \tag{4.16}$$

The following proposition captures the newspaper's optimal prices.

Proposition 2 *The optimal pricing policy of the newspaper is such that:*

$$t_j^* = \max\left[N^R - \alpha V_{0,j}, 0\right] \tag{4.17}$$

$$h^* = \frac{1}{2}\frac{\left(\overline{\theta}\alpha\overline{V} - 1\right)\left(2\overline{\theta} + x\right)}{2\overline{\theta}\alpha\overline{V} - 1}, \tag{4.18}$$

$$p^* = h^* + \frac{x}{4} \tag{4.19}$$

Proof Differentiating with respect to h and p, and solving the system of two equations, yields the formulas stated in the proposition.■

Not surprisingly, we find that the price charged to occasional readers is higher than that charged to subscribers. Interestingly, in this simplified model, we find that it is always optimal for the newspaper to engage in second-degree price discrimination on the readers' side so long as $x > 0$, that is, so long as there is some uncertainty over the taste for reading that can be exploited. Indeed, recall that it is without loss of generality for the newspaper to set prices such that $p \geq h$ since the outcome without subscription can always be replicated by setting $p = h$.

Corollary 1 *An increase in the common component of the advertisers' outside options α leads to an increase in the prices on the readers' side.*

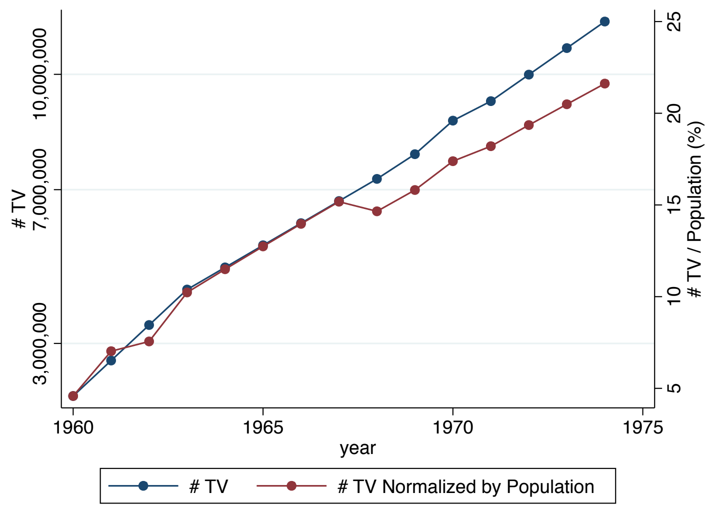
Proof Follows from differentiating the formulas for the prices stated in Proposition 2 with respect to α. ■

Intuition The intuition for this result is as follows. The presence of advertisers whose payoff increases with the average number of readers leads to the newspaper charging lower prices to readers that it would choose absent advertisers. If the benefit of doing so is high enough, readers could even be charged prices below marginal cost (they would then be effectively subsidized). The benefit of doing so to the newspapers naturally comes from the fact that the created surplus can be then extracted through the price charged to advertisers. Now, if the advertisers' outside option increases so that lower prices must be charged, it becomes less interesting for the newspaper to cater to their taste, and we thus observe a movement in the prices charged to the readers towards what they would be absent advertising: higher.

4.3 Industry and Data Characteristics

The model we built in the previous section provided us with a general framework with which to think about the determinants of pricing policies by newspapers, including the extent of price discrimination. In this section, we study empirically how price discrimination varies with advertising revenues. The empirical strategy we follow is in the spirit of an event study. We exploit the introduction of advertisement on French Television in October 1968 as an exogenous negative shock on the advertising side of newspapers. To the best of our knowledge, we are the first to use this quasi-natural experiment.

In this section, we first present some historical background on the introduction of advertisement on French Television in 1968, and then describe the new dataset we built for this study.



Notes: This Figure represents the evolution of television penetration in France between 1960-1974. Data on television equipment is from studies conducted for the advertising market (PROSCOP) and data on population is from the French national institue for statistics (INSEE).

Figure 4.1: *TV Penetration in France, 1960-1974*

4.3.1 Historical Background: the Introduction of Advertisement on French Television

French Television is state-owned from 1945 to 1981.[5] A national agency – the *"Office de Radiodiffusion-Télévision Française"* (ORTF) – is in charge of providing radio and television content.[6] Only one channel (*"La première chaîne"* – the "First Channel") is available until 1963. A second TV channel (*"La deuxième chaîne*" – the "Second Channel") is introduced in 1964 and a third one (*"La troisième chaîne"* – the "Third Channel") in 1972. TV penetration is increasing at the time, as shown in Figure 4.1. In 1970, nearly 70% of the French households own a television (Parasie, 2010).

Channels are financed mostly through a fee (*redevance*) until 1968. By law, *commercial* or *brand* advertising is forbidden, with the exception of "collective advertising". Collective

[5]During this period all TV channels are privately-owned in the US, while in the UK two TV channels are state-owned (BBC 1 and BBC 2) and one is private (ITV).

[6]The first national agency, the *"Radiodiffusion Française"* (RDF), is created in 1945. It is eventually renamed *"Radiodiffusion-Télévision Française"* (RTF) in 1949 and replaced by the ORTF in 1964.

ads promote products, say fruits, without mention of a brand.[7] In 1959, the time devoted to collective advertising is only of five hours and ten minutes per year, but its importance is growing; in 1966 it represents $3,3\%$ of the ORTF's total budget (Parasie, 2010). From about 36 million francs (43 (constant 2009) million euros[8]) in 1966, collective advertising generates 40 million francs (€46.5 million) of revenues to ORTF in 1967 and 51 million francs (€56.8 million) in 1968 (Bellanger, 1969).[9]

The transition to color on the Second Channel and the need to produce an increasing number of programs means that the ORTF experiences severe financial difficulties – it is *"on the edge of the abyss"* (Bellanger, 1969).[10] Secretly decided by the French Government in March 1965, the introduction of advertisement on television is made public on October 20th 1967, thereby provoking a strong controversy both in Parliament and within the Newspaper Industry. The then Prime Minister George Pompidou argues that the ORTF has no choice but to find new sources of revenues to develop the Second Channel and eventually create a third one. He also argues that the introduction of advertisement on television will *"revitalize the production by giving to our firms the possibility to develop their domestic market, essential support to any exporter activity."* (address in Parliament on April 24 1968).[11]

The introduction of advertisement on television: a threat to newspapers? Left-leaning political parties and the Newspaper Industry were firmly against the reform. The Federation of the Democratic and Socialist Left (*"Fédération de la gauche démocrate et socialiste*3) – a

[7]These are allowed since the 1950's and are also referred to as "compensatory advertising" (*"publicité compensée"*), where the term"compensatory" captures the fact that the ORTF would receive a compensation in exchange for the broadcast (Duchet, 2005). Not only advertisers have to constitute associations, but an advertising campaign also needs the approval of the supervisory Ministry (e.g., the Ministry of Agriculture for oranges).

[8]In the remainder of the paper, to save on space, we simply use the terminology "euros" when refering to "constant 2009 euros".

[9]According to Duchet (2005), it represents 42,000 francs (€0.084 million) in 1951, 15 million francs (€19.5 million) in 1963, 19 million francs (€23.9 million) in 1964 and 28 million francs (€34.4 million) in 1965.

[10]Beginning on October 1st 1967, the Second Channel broadcasts twelve hours a week of programs in color.

[11]Commercial advertising is allowed much earlier in almost all other developed countries: it is allowed in 1941 in the US, in 1955 in the UK, in 1956 in Germany, and in 1957 in Italy and Spain (Parasie, 2010).

conglomerate of French left-wing non-Communist forces – introduced various bills to ban commercial advertising on television by arguing that it would lead to a decrease in the quality of television content. More importantly – and consistently with the identification strategy we use in this paper –, very much present is the idea that the reform would lead to a decrease in newspaper advertising revenue.[12] In fact, already in 1964, the Minister of Information of the time, Alain Peyrefitte, was aware of this issue and claimed that the introduction of advertisement on television would be worth considering only if the press could survive it (Bellanger, 1969).

Similarly, newspapers are against the reform as they anticipate a decrease in their advertising revenues. In the local daily newspaper *La Marseillaise* one can read on March 23rd 1968, in a page 9 article entitled *"The weekly newspapers against advertising on Television"*: *"(...) the national federation of weekly and periodical newspapers reaffirms again its absolute opposition to the introduction of commercial advertising on television that would lead to questioning the existence of an important number of newspapers and harm the freedom of expression"*. And indeed, as underlined by Bellanger (1969), *"in terms of* national *advertising (...) in a limited market, any drain leads to a decrease in the advertising revenues which the press lives off"*. The Federation and the Confederation of the French Press estimated in a report that the press would lose between 40 and 50% of its advertising revenues, i.e., between 20 and 40% of total revenues depending on the newspaper (Bellanger, 1969).

Despite these strong resistances from the newspaper industry, the first advertisement is broadcasted on French Television in October 1968. The time devoted to advertising is of 2 minutes per day in 1968 – only on the First Channel –, 4 in 1969, 8 in 1970 (i.e. 2,720 minutes per year) – year in which advertising is introduced on the Second Channel, and more than 12 in 1971 (Bellanger, 1969).

In order to provide a sense of the effect of the introduction of advertisement on television

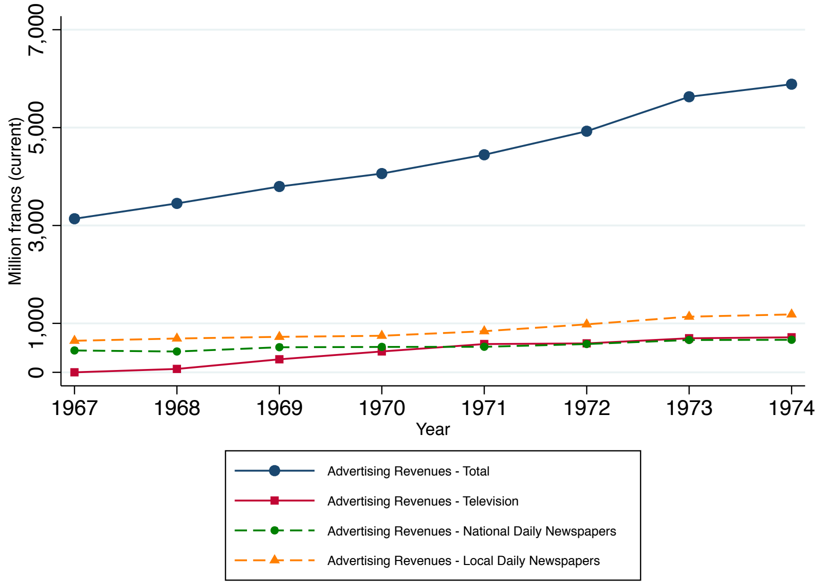
[12]The Federation of the Democratic and Socialist Left argues that the government wishes to introduce advertisement on television so as to weaken newspapers, the only independent media (Parasie, 2010). In an address to the Parliament on April 24 1968, Jacques Chambaz (from the Communist Party) claims that *"the introduction of commercial advertisement on television is but a new way to deal a blow to the broadsheet newspapers that you consider not docile and flexible enough."*

on the advertising revenues of local and national daily newspapers, we first provide aggregate evidence using data from the *"Institut de Recherches et d'Etudes Publicitaires"* (IREP), a French research institute devoted to the study of advertising. As appears clearly in Figure 4.2, the advertising market is expanding in France between 1967 and 1974. In particular, total advertising revenues increase from 3,137 million francs (€3,649 million) in 1967 to 3,451 million francs (€3,841 million) in 1968 and about 3,796 million francs (€3,971 million) in 1969 (Figure 4.2a). Importantly, this increase is almost entirely due to the new advertising revenues generated by the ORTF, which increase by 69 million francs (€77 million) between 1967 and 1968 and by 197 million francs (€201 million) between 1968 and 1969. In 1971, advertising revenues represent 22% of the ORTF total revenues (Bellanger, 1969).

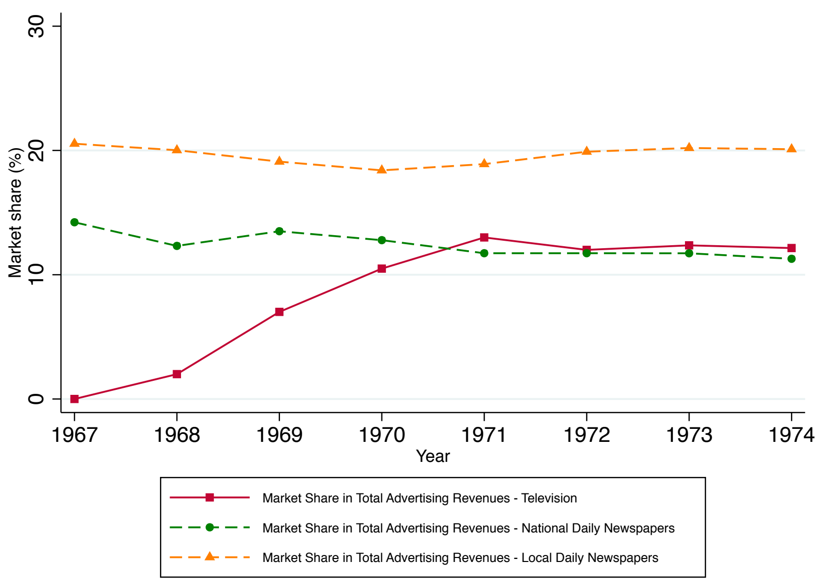
In sharp contrast, total advertising revenues of national daily newspapers decrease by 21 million francs (€45 million) between 1967 and 1968, and then stabilize around 500 million francs. The introduction of advertisement on television in 1968 can thus be considered as a significant negative shock on the advertisers' side of the newspaper industry. In Section 4.4, we provide econometric evidence of this shock, computing differences-in-differences estimates to show that this shock affects negatively the advertising revenues of the national daily newspapers, but not those of the local daily newspapers.

Before turning to the description of the newspaper industry characteristics, let us underline that this shock would in all likelihood have been much stronger had the introduction of advertisement on television not been regulated. As emphasized by Jacques Chaban-Delmas, Primer Minister of the time, in an address to the Parliament on November 8 1971: *"the government has voluntarily limited the growth of brand advertisement"* in order to avoid a *"disruption of the advertising market likely to cause damage to (...) the press"* (Duchet, 2005). A 1972 law indeed limits the share of advertising revenues in the total revenues of the ORTF to 25% (Parasie, 2010).[13] As we show below, however, National newspapers nevertheless suffer from the introduction of advertisement on television.

[13] In fact, the ORTF is still loosing money in the early 1970s (Duchet, 2005).



(a) *Advertising Revenues (in million francs)*



(b) *Advertising Revenues - Market Shares*

Notes: The Figure shows for each year between 1967 and 1974 the evolution of advertising revenues in France by media outlets (television, local and national daily newspapers). The upper figure (4.2a) shows advertising revenues in million francs. The bottom figure (4.2b) shows advertising revenues for each media outlet as a share (in %) of total advertising revenues. Data is from the IREP.

Figure 4.2: *Advertising Revenues, 1967-1974, by Media Outlets*

4.3.2 Newspaper Industry Characteristics

The French daily newspaper industry is divided into two sub-industries: the *local* daily newspaper industry and the *national* daily newspaper industry. During our period of interest (1960-1974), there are around 100 (national and local) newspapers – with a small decrease in this number.

There are 16 national newspapers at the beginning of the period and 13 at the end.[14] Out of these 13 national daily newspapers, 10 are general information newspapers, while the others are either sport or financial newspapers. Since local newspapers are general information newspapers, we only consider national general information newspapers for the sake of comparison.[15] These 10 newspapers represent 95% of the total national daily newspaper circulation. The total national newspaper circulation is stable during this time period, with around 4.2 million copies sold every day. The number of local newspapers during the same period varies around 90, with a total circulation amounting to around 7.8 million copies (see the first chapter of this dissertation for more details on the historical evolution of the French local daily newspapers industry). On average, the circulation of national daily newspapers amounts to nearly 350,000 copies a day and the one of local daily newspapers to 100,000. Copies are sold either at the newsstand to unit buyers or through subscription. The average share of unit buyers is 70%.[16] As expected, the price charged to subscribers is lower than the price paid by unit buyers at the newsstand. The average price ratio is 0.86; it is lower for national daily newspapers (0.80) than for local newspapers (0.87). (Table 4.1 provides descriptive statistics on newspaper prices, revenues and costs as well as on circulation and newspaper content for the entire daily newspaper industry.)

[14]Two general information newspapers – *Libération* and *Paris Presse* – exit the industry respectively in 1964 and in 1970 –, as well as one financial newspaper.

[15]We drop sport newspapers (e.g., *L'Equipe*) as well as financial newspapers (e.g., *Les Echos*).

[16]The statistical discrepancy between the share of unit buyers and the share of subscribers – that do not sum up to 100 – stems from the fact that a number of copies is distributed for free every day.

Table 4.1: *Summary Statistics*

	mean/sd
Prices	
Unit Price	0.44
	(0.20)
Subscription Price Per Issue	0.38
	(0.17)
Price Ratio	0.86
	(0.07)
Revenues and Costs	
Total Revenues	26.51
	(38.37)
Revenues from Advertising	12.90
	(22.03)
Revenues from Sales	13.57
	(18.47)
Share of Advertising in Total Revenues (%)	45
	(11)
Total Expenditures	25.67
	(38.04)
Profit	0.89
	(6.32)
Circulation	
Total Circulation	135,332
	(178,546)
Share Unit Buyers (%)	70
	(23)
Share Subscribers (%)	27
	(22)
Content	
Total Number of Pages per Issue	16
	(7)
Quantity of Advertising per Issue (in number of pages)	2
	(2)
Share of Advertising in Newspaper Content (%)	11
	(7)
Observations	1008

Notes: The Table gives summary statistics. Numbers in parentheses are standard deviations and the others are averages. Time period is 1960-1974. Variables are values for newspapers. Unit price and subscription price per issue are in francs. Revenues and costs are in million francs.

Advertising in newspapers Overall, national daily newspapers generate 67.5 million francs (€71.4 million) in total revenues each year, and local daily newspapers 19.9 million francs (€20.4 million). These revenues come from sales and from advertising. On average, between 1960 and 1974, the share of advertising revenues in total revenues is 45%. The quantity of advertisement in newspapers represents around 2 pages per newspaper issue, i.e., 11% of the content of the newspaper.

More advertising is found in national newspapers than in local ones. In addition, the nature of advertising varies between national and local newspapers. In particular, we argue that national newspapers are more affected by the introduction of advertisement on television than local newspapers because their advertising consists mostly of commercial ads that are relatively close substitutes to those broadcasted on television while a large share of advertising in local newspapers is local in nature (local commercial advertisements and classified advertisements). According to the IREP data, the share of local advertisements in the advertising revenues of local daily newspapers is 43% in 1967 and increases up to 55% in 1974, while the share of local commercial advertisements in commercial advertisements increases from 52 to 72%.

Advertisements broadcasted on television tends to be relatively close to the ones published in national newspapers. We collect data on all the advertisements broadcasted on French Television between 1968 and 1974 from the website of the *Institut National de l'Audiovisuel* (INA – National Audiovisual Institute), and classify them by group (e.g., alimentation, automobile, household electrical goods,...) as well as by brand. When we compare these advertisements to the ones published in both national and local daily newspapers between 1960 and 1974, the substitution pattern between national newspapers and television appears very clearly.

4.3.3 Data

In this section, we briefly describe the new dataset we have constructed for this paper from archive data on newspapers' price, revenues, expenditures and circulation, as well as on the quantity, type and price of advertisements in newspapers. Producing these data is an important contribution of the research.

4.3.3.1 Newspaper Data

We collect an annual balanced panel dataset on local and national newspapers in France between 1960 and 1974 in order to study the impact of the introduction of advertisement on television in 1968. The data is paper data that we digitize and merge from the French Ministry of Information's non-publicly available records in the National archives. Newspapers were asked by the Ministry of Information to report annually on revenues and expenses. We collect data by having direct access to their responses to these queries.

Local and national newspapers Our dataset includes data for 61 of the local newspapers, i.e., more than three quarters of the local daily newspapers industry in 1971. These newspapers are the only ones for which the data is available in the archives. They represent on average more than 87% of the total local daily newspaper circulation. Our sample of national newspapers include all the 10 general information national newspapers circulating between 1960 and 1974.

Price, cost and revenue data For the 71 newspapers described above we collect data on prices with information on unit price, subscription price, and the number of issues per year. This allows us to compute a measure of price discrimination. We also have data on revenues (from sales and from advertising), and on costs. Finally, we have data on circulation with the share of unit buyers and the share of subscribers.

Advertising prices and quantity A change in advertising revenues can be driven by either or both a change in advertising prices or a change in advertising quantity. We collect data on both the price and the quantity of advertising in order to disentangle the two effects.

A first source of information for advertising prices are the listed prices per advertising slot. We digitize this data from *"Tarif Media"*, an annual publication that provides information regarding advertising prices. However, a downside of using listed prices is that discounts are common in this industry. Price lists are hence a relevant measure of advertising prices as long as we assume that the potential bias between list prices and actual prices does not differ too much across newspapers and over time.

Given this caveat, we propose three other measures of advertising prices. First, we use a measure of advertising price common in the literature, which consists of the total advertising revenues divided by the newspaper circulation. Second, we compute an "average" advertising price by dividing the total advertising revenues by the average amount of advertisements in each newspaper issue, multiplied by the number of issues. Third, we combine the two previous approaches and define the advertising price as the total advertising revenues divided by the average amount of advertising per issue, multiplied by the number of issues and normalized by the newspaper circulation.

We collect data on the amount of advertising per issue directly from the paper version of the newspapers available in the French National Library. For each year and each newspaper, we select two issues (Monday and Thursday of the third week of March[17]). We measure the quantity of advertising on each page. We thus have information on the total amount of advertisements in the newspaper, and the share of the newspaper that is devoted to advertising. Moreover, we also collect information on the type of advertisements in the newspapers and obtain information on the category of each advertisement (e.g. alimentation, automobile, household electrical goods,...) as well as on the brand advertising in the newspaper.

[17]The choice of the third week of March was dictated by the fact that this is the week used by the INSEE to run all its surveys.

4.4 Empirical Analysis

4.4.1 Estimation Strategy

We use our panel data to compute differences-in-differences (DD) estimates of the effect of the introduction of advertisement on television. The negative shock on newspaper advertising revenues following this introduction (our treament) only affects national newspapers (treated group) but not local newspapers (control group). We thus compare the pre-1968-to-post-1968 change in prices of national daily newspapers to the change in prices of local daily newspapers over the same period.

Let $D_{\text{national news}}$ be an indicator variable for national newspapers and D_{after} be a time dummy that switches on for observations post 1968 (i.e., after the introduction of advertisement on television). Our analysis is based on the following regression equation:

$$\begin{aligned} \text{log price ratio}_{n,t} = & \alpha + \beta_1 D_{\text{after}} + \beta_2 D_{\text{national news}} + \beta_3 \left(D_{\text{after}} * D_{\text{national news}} \right) \\ & + X'_{n,t}\delta + \lambda_n + \gamma_t + \epsilon_{n,t} \end{aligned} \tag{4.20}$$

where n indexes newspapers and t indexes years ($t = 1960, ...1974$). λ_n is a newspaper fixed effect, γ_t is a year fixed effect, and $\epsilon_{n,t}$ is a newspaper-year shock. $X'_{n,t}$ is a vector of newspaper-level controls; it includes circulation and operating costs. Standard errors are clustered at the newspaper level.

The dependent variable, log price ratio$_{n,t}$, is the log of the price ratio of newspaper n in year t defined as the subscription price per issue divided by the unit price. We assume that the difference in prices charged to unit buyers and subscribers is entirely due to price discrimination and use the price ratio as our measure of price discrimination (Clerides, 2004). Obviously, part of the difference between the prices charged to unit buyers and subscribers may be driven by differences in costs, in particular costs of delivery. However, our assumption is valid in the DD setting as long as the introduction of advertisement on television did not affect costs of delivery.[18]

Due to the inclusion of newspapers and year fixed effects, the coefficient β_3 – our coefficient of interest – measures the annual price ratio effect for national newspapers of the introduction of advertisement on television compared to the general evolution of the price ratio for local newspapers. The key identifying assumption here is that price trends would be the same for both categories of newspapers (local and national) in the absence of treatment. The treatment induces a deviation from this common trend. Figure 4.3 provides strong visual evidence of treatment and control newspapers with a common underlying trend, and a treatment effect that induces a sharp deviation from this trend. However, as an alternative check on the DD identification strategy, we add an industry-specific time trend to the list of controls. In other words we estimate:

$$\begin{aligned} \log \text{price}_{n,t} = & \alpha + \beta_1 D_{\text{after}} + \beta_2 D_{\text{national news}} + \beta_3 \left(D_{\text{after}} * D_{\text{national news}} \right) \\ & + \mu_{1\text{national}} t + X'_{n,t} \delta + \lambda_n + \gamma_t + \epsilon_{n,t} \end{aligned} \tag{4.21}$$

where $\mu_{1\text{national}}$ is a national newspapers industry-specific trend coefficient multiplying the time trend variable t. The introduction of these industry-specific time trends allows treatment and control newspapers to follow different trends in a limited but potentially revealing way.

Finally, the unbiasedness of the DD estimates requires the strict exogeneity of the introduction of advertisement on television. As we underline above, French Television is state-owned from 1945 to 1981. There is thus no interaction between television owners and newspaper owners, be they national or local. The introduction of advertisement on television was decided unilaterally by the French government to answer the concerns of the ORTF. It is exogenous to the newspaper industry.

[18] Future work will aim at isolating the part of the difference in prices which reflects differences in costs (non-discriminatory price differences) using relevant observed cost shifters (delivery costs are unobserved).

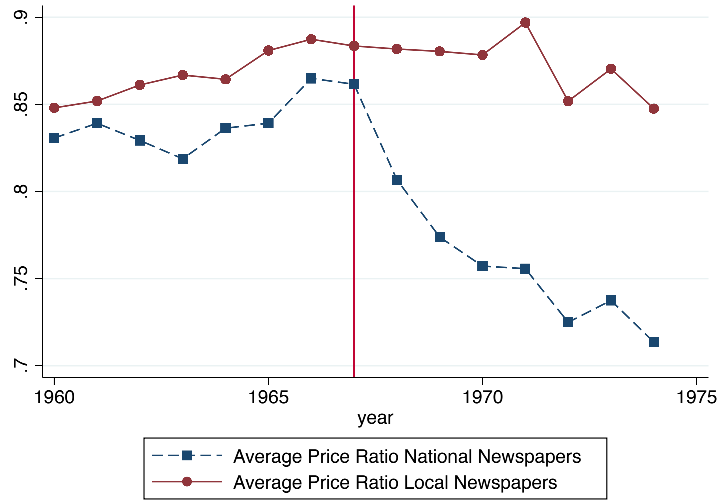


Figure 4.3: *Descriptive Evidence: Changes in Price Discrimination.*

4.4.2 Results

4.4.2.1 Benchmark Estimates

Table 4.2 reports estimates of equations (4.20) and (4.21). It appears clearly in column 1 (baseline estimation without controls and time trends) that there is a statistically significant decrease in the price ratio – our measure of price discrimination – of national newspapers compared to local newspapers following the introduction of advertisement on television. Moreover, this negative effect is robust to controlling for a national newspapers industry-specific time trend which is reassuring as to the validity of our DD identification strategy (column 2). This result is also robust to the introduction of newspaper-level controls (column 3).

4.4.2.2 Timing of the Effect

This before-after event study approach enables us to control for time-invariant newspaper-specific effects and general time trends. As an additional robustness check, we allow for flexible time-varying effects of the negative shock on advertising revenues (Laporte and

Table 4.2: *The Effect of the Decrease in Advertising Revenues on the Price Ratio: Baseline Estimation*

	Price Ratio		
	(1)	(2)	(3)
National x Post-1968	-0.12***	-0.07***	-0.07***
	(0.02)	(0.02)	(0.02)
Year FE	Yes	Yes	Yes
News FE	Yes	Yes	Yes
Industry-Specific Trend	No	Yes	Yes
News Controls	No	No	Yes
R-sq	0.14	0.14	0.20
Observations	968	968	955
Clusters (news)	71	71	71

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by newspaper. Time period is 1960-74. Models are estimated using OLS estimations. Newspaper controls are newspaper circulation and expenditures. Variables are described in more details in the text.

Windmeijer, 2005). To quantify the dynamics effects of the event and control for lags and leads, we define ("pulse") variables for two, non-overlapping, three-years spaced periods around the event and a dummy variable isolating the long-run effect of the shock (see e.g. (Papaioannou and Siourounis, 2008)).

Our specification is:

$$\begin{aligned} \text{log price ratio}_{n,t} = &\alpha + \delta_1 d^1_{n,t} + \delta_2 d^2_{n,t} + \delta_3 d^3_{n,t} \\ &+ X'_{n,t}\Delta + \lambda_n + \gamma_t + \epsilon_{n,t} \end{aligned} \tag{4.22}$$

where $d^1_{n,t} = 1$ in 1966, 1967 and 1968 for national newspapers (pre introduction of advertisement on television); $d^2_{n,t} = 1$ in 1969, 1970 and 1971 for national newspapers (at the time of the introduction and in the following years); and $d^3_{n,t} = 1$ in 1972 and all subsequent post-introduction years (until 1974). Each indicator variable equals zero in all other years than those specified and for local newspapers. Thus the base period is the years before 1966.

Table 4.3 presents the results. In column 1 we report the results without controls, and in column 2 we introduce newspaper-level controls. We find no statistically significant effect (with a point estimate close to zero) for the pulse variable $d^1_{n,t} = 1$. This is reassuring as

Table 4.3: *The Effect of the Decrease in Advertising Revenues on the Price Ratio: Timing of the Effect*

	Price Ratio	
	(1)	(2)
Pre Introduction of Advertisement on TV		
(1966-1968)	-0.02	-0.02
	(0.02)	(0.02)
Short-Run Introduction of Advertisement on TV		
(1969-1971)	-0.12***	-0.12***
	(0.01)	(0.02)
Long-Run Introduction of Advertisement on TV		
(1972, onwards)	-0.13***	-0.15***
	(0.02)	(0.02)
Year FE	Yes	Yes
News FE	Yes	Yes
News Controls	No	Yes
R-sq	0.14	0.19
Observations	968	955
Clusters (news)	71	71

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. Standard errors in parentheses are clustered by newspaper. Time period is 1960-74. Models are estimated using OLS estimations. Newspaper controls are newspaper circulation and expenditures. Variables are described in more details in the text.

to the validity of our DD strategy. Moreover, as expected given the results of Table 4.2, we obtain a negative and statistically significant at the 1% level δ_2: there is a statistically significant decrease in the price ratio – i.e., in the extent of price discrimination – of national newspapers compared to local newspapers following the introduction of advertisement on television. This effect is long lasting: the δ_3 is statistically significant and the point estimates is higher than for the short-run effect (column 1) and increases when we introduce controls (column 2).

Finally in Table 4.4, we investigate the effect of the introduction of advertisement, using the same empirical strategy, separately for unit prices and subscription prices. It appears that the decrease in the price ratio is entirely driven by a decrease in the subscription price, while there is no statistically significant change in the unit price charged to unit buyers at the newsstand. Moreover, we find a statistically significant decrease in the advertising price

Table 4.4: *The Effect of the Decrease in Advertising Revenues on Different Prices: Timing of the Effect*

	Unit Price	Subscription Price	Advertising Price
	(1)	(2)	(3)
Pre Introduction of Advertisement on TV			
(1966-1968)	-0.02	-0.04	-0.17
	(0.03)	(0.03)	(0.22)
Short-Run Introduction of Advertisement on TV			
(1969-1971)	0.02	-0.10***	-0.52**
	(0.03)	(0.02)	(0.23)
Long-Run Introduction of Advertisement on TV			
(1972, onwards)	-0.01	-0.15***	-0.58**
	(0.04)	(0.03)	(0.26)
Year FE	Yes	Yes	Yes
News FE	Yes	Yes	Yes
News Controls	Yes	Yes	Yes
R-sq	0.93	0.90	0.21
Observations	955	955	590
Clusters (news)	71	71	48

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by newspaper. Time period is 1960-74. Models are estimated using OLS estimations. Newspaper controls are newspaper circulation and expenditures. Variables are described in more details in the text.

charged by national newspapers compared to local newspapers following the introduction of advertisement on television. This effect is long lasting: the δ_3 is statistically significant and the point estimates is higher than for the short-run effect when advertising price is the outcome variable of interest.

4.5 Conclusion

We have built a model in which a profit-maximizing newspaper must attract both readers and advertisers. Particular attention has been paid to the incentives the newspaper has to engage in second-degree price discrimination between subscribers and occasional buyers, and how these incentives interact with the advertisers' side of the industry, and in particular the reliance on advertising revenues.

In our model, there is scope for second degree price-discrimination because of the readers' uncertainty regarding their utility from reading in future periods. The newspaper sets its prices such that readers with a high average taste for reading subscribe at a relatively low unit cost, while readers with an intermediate average taste for reading only buy occasionally – but at a high price – when their utility from reading on that day is high. One general tendency that emerges is that, as long as advertisers prefer large readerships to smaller one, prices charged to readers tend to be lower than absent the advertisers' side of the industry. Following a general increase in the outside option of newspapers we therefore find that prices tend to go up. As for the extent of price discrimination, the interaction with the advertisers' side is more subtle since then elasticities, group sizes, as well as the average taste of marginal advertisers (those indifferent between placing an ad or not) are all relevant. According to the empirical evidence we obtain using French daily newspapers between 1960 and 1974, price discrimination increases when advertising revenues decline.

This empirical finding has implications for the 21st century newspaper industry. In particular it sheds light on the observed current tendency for newspapers to favor subscriber-based readerships through low subscription prices (and high newsstand prices). What our paper suggests is that when newspapers are less capable of generating revenues from advertising, all else equal, they tend to adjust their pricing policies on the readers' side so as to increase the share of subscribers. As advertising revenues continue declining, we should thus expect this tendency to reinforce itself in the coming years.

Chapter 5

The Economics of the African Media[1]

5.1 Introduction

Building State capacity. Making governments more accountable. Fighting corruption. Improving the provision of public goods. These challenges are central for achieving long-term sustainable and inclusive growth in developing countries, especially in sub-Saharan Africa.[2] A common denominator and a necessary condition for these countries to succeed and to develop democratically[3] – condition that one tends to forget from today's developed countries' perspective – is the power of information. An informative press is indeed a potent check on corruption; it enhances effective and active monitoring of public goods delivery (for example health and education) and is an instrument of public accountability.[4] Moreover, not

[1]Prepared for the *Oxford Handbook of Africa and Economics*.

[2]The geographical coverage of this chapter is partial. Because North African and sub-Saharan African newspapers developed differently at different time periods, and because the current state of the media market differs from one region to the other, analyzing both cases is beyond the goal of this work. The focus of this chapter is on sub-Saharan Africa; this geographical choice is driven both by the need to increase our knowledge of the sub-Saharan African media market – I will come back to this point below but nearly no research in economics has been done on this topic –, and by the lessons that can be learned from this special case for other developing and developed countries.

[3]Of course many countries – China is but one example – have developed, i.e. grow economically, without a free media. But in these countries corruption is still very high and economic growth tends not to be inclusive.

[4]Using the example of Sierra Leone, Casey (2013) shows that the quality of information available to voters influences the choices they make in the polling booth and in turn affects the strategies of political parties competing for their support in developing countries. Cagé (2009) finds that increasing the information available

only a free and informative press is crucial to good governance and democratic development, but it also affects economic development – through its impact on social capital (Olken, 2009) or women empowerment (Jensen and Oster, 2009) – as well as the effective functioning of markets.[5]

Despite this central importance of an informative press for the future of Africa, the literature has overlooked the issue of what makes it viable.[6] The media are businesses and are shaped by many economic factors. The focus of this chapter is on the economics of the sub-Saharan African media.[7] Using the history of sub-Saharan African newspapers as well as historical evidence from Europe and the United States, I study the rise – and sometimes the failure – of market-oriented journalism and of an independent and informative press in sub-Saharan Africa. Do sub-Saharan African newspapers have followed the same "steps" of development than newspapers in other countries, moving from living off patronage and government favors to moving more towards mass sales and advertising revenues? And is the story of the sub-Saharan African media a simple story of catching up and convergence?

One may argue that it would be absurd to make too many broad generalizations about media in sub-Saharan Africa. But when it comes to the economics of the media, sub-Saharan African countries share certain features in common. Importantly, through the study of the economics of the sub-Saharan African media, this chapter challenges two traditional views of the media. First, the study of Africa shows that there exist multiple possible

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to citizens increases the efficiency of official development aid in developing countries. Exploiting a newspaper campaign in Uganda aimed at reducing the capture of public funds by providing schools with systematic information to monitor local officials' handling of a large education grand program, Reinikka and Svensson (2005) show that public access to information can be a powerful deterrent to the capture of funds at the local level and that the reduction in the capture of funds that resulted had a positive effect on school enrollment and learning outcomes.

[5]Using the Market Information Service project in Uganda – that collected data on prices for the main agricultural commodities in major market centers and disseminated the information through local FM radio stations in various districts – (Svensson and Yanagizawa, 2009) show that market information improves farmers' relative bargaining position vis-à-vis local traders.

[6]More generally, the focus of the media economics literature until now has been on developed countries, especially the United States. In my view, one of the main challenges today is to study the media – and how it affects the political process –in developing countries.

[7]The main focus of this chapter is on print media (newspapers) rather than on television or radio. I come back to this point below.

long-term paths in media development. In particular, this chapter questions the long-term sustainability of advertising-dependent media systems; it discusses a new framework to improve the financial sustainability of mass media while preserving the independence of media outlets. Second, this chapter questions the view that more media competition is always socially efficient and necessary to ensure diversity. Press freedom and diversity are naturally desirable; but we learn from the history of sub-Saharan Africa media that chaotic proliferation of low-quality media outlets may be bad. In order to analyze the optimal industrial organization of the media sector, it is critical to better understand the economic incentives of the media to deliver news (see e.g. Chapter 1 of this dissertation).

One may think that an analysis of the economics of the media with a focus on newspapers in developing countries, especially in sub-Saharan Africa, is a misplaced emphasis. Not only radio has the widest population reach in sub-Saharan Africa[8] but, as we will see, newspaper penetration is still very low in a number of African countries compared to developed countries where the newspaper market is of much more importance. The point, however, is that countries in Africa are among the only countries in the world where the reading of newspapers will continue its expansion during the coming decades. While newspaper sales are generally said to be falling, as traditional print media struggle to compete with broadcasting and online media, newspaper circulations are growing in many countries across sub-Saharan Africa: the newspaper market expands as literacy steadily increases, whereas other media like television or the internet require capital that most sub-Saharan Africans do not have. More importantly, newspapers tend to be relatively independent, while in most sub-Saharan African countries, State-controlled radio and television services still command the biggest audiences.[9] On the whole, private newspapers tend to be more

[8]Television is less widely available, although it is seen as growing force.

[9]In Angola, the government has a monopoly on all TV and national radio. All terrestrial channels are owned by the state. The state owns and runs the two major radio stations and has a monopoly on television in Botswana. In Cameroon, the state-run Cameroon Radio Television (CRTV) is the only station with a national footprint. Similarly, in Chad, the only radio station with nationwide reach is the government-run Radiodiffusion Nationale du Tchad and the only TV station is the state-run TéléTchad. State-run Radio Television Ivoirienne has an official monopoly on free-to-air television broadcasting in Cote d'Ivoire and is tightly controlled by the government. In Ethiopia, nearly all radio and TV stations are owned by the government. While state-owned

outspoken than radio and television stations.

Before turning to the analysis, let me finally underline that there is a dearth of publicly available data on the media sector in sub-Saharan Africa, both for historical and current data; future research should aim at filling this knowledge gap. In this chapter, I use data that I collected for previous research I did on sub-Saharan African media, as well as a number of different data sets.[10]

The rest of the chapter is organized as follows. Section 5.2 provides a very simple conceptual framework to rationalize the relationship between the quality of the media and political well-being. Section 5.3 discusses the historical development of the African Media. Section 5.4 provides evidence on the current state of the African media and highlights that the traditional media system models need to be enhanced to understand the complexity of the sub-Saharan African situation and to draw lessons for the future and for the rest of the world. Section 5.5 presents alternative economic models for the press. Section 5.6 concludes.

5.2 A Very Simple Conceptual Framework

What is the relationship between the quality of the media and political well-being? We know at least since Condorcet (1785) that political institutions have a constructive role to play in order to allow for an efficient aggregation of all the socially-useful information that is dispersed among individuals (see e.g. Piketty (1999), who discusses this information-

Ethiopian Radio is the dominant radio player, the state-owned Ethiopian Television retains its monopoly on domestic-free-to-air TV. In Ghana, the only nationwide radio broadcaster is the state-owned Ghana Broadcasting Corporation and state-owned Ghana TV is the only station that has a national broadcast footprint. Similarly in Guinea, Guinea's state broadcaster Radiodiffusion-Television Guinéenne is the country's only nationwide radio and television services. These are but a few examples.

[10] Angola (AMDI), Benin (Afrobarometer), Botswana (AMDI, Afrobarometer); Cameroon (AMDI); Chad (Infoasaid); Côte d'Ivoire (Infoasaid); Democratic Republic of Congo (AMDI, Infoasaid); Ethiopia (AMDI, Infoasaid); Ghana (AMDI, Afrobarometer); Guinea (Infoasaid); Kenya (AMDI, Afrobarometer, Infoasaid); Lesotho (Afrobarometer); Madagascar (Afrobarometer); Malawi (Afrobarometer); Mali (Afrobarometer); Mozambique (AMDI, Afrobarometer, Infoasaid); Namibia (Afrobarometer); Niger (Infoasaid); Nigeria (AMDI, Afrobarometer, mediaReach OMD); Senegal (AMDI, Afrobarometer); Sierra Leone (AMDI); Somalia (AMDI, Infoasaid); South Africa (AMDI, Afrobarometer, mediaReach OMD); South Sudan (Infoasaid); Tanzania (AMDI, Afrobarometer, Ipsos); Uganda (AMDI, Afrobarometer; Ipsos); Zambia (Afrobarometer, AMDI); Zimbabwe (AMDI, Afrobarometer, Infoasaid). AMDI stands for "American Media Development Initiative".

aggregation approach to political institutions). While information pertinent to individual decisions never exists in aggregated form but solely as the dispersed bits of incomplete information, efficient political institutions should allow for an efficient use of these dispersed bits of information.

The so-called “Condorcet Jury Theorem" can be – in its simplest form – stated as follows. First, assume that a population of size N has to choose between two possible policies $P = A$ or B and that all agents have the same state-dependent utility function $U(P/s)$; in other words, if the state of the world s is equal to s_A, they all prefer policy A to policy B: $U(A/s_A) > U(B/s_A)$. Second, assume that all agents have the same initial prior beliefs about the unobservable state of the world $\mu(s_A) = \mu(s_B) = \frac{1}{2}$. Finally, assume that all agents receive a signal $\sigma = \sigma_A$ or σ_B drawn from the same conditional distribution, such that $Prob(\sigma_A/s = s_A) = Prob(\sigma = \sigma_B/s = s_B) = p > \frac{1}{2}$. The Condorcet Jury Theorem states that if majority-rule voting elections are held, the probability that the efficient policy (A in state s_A, B in state s_B) wins a majority of the vote tends to 1 as N goes to $+\infty$. In other words, majority-rule voting allows efficient information aggregation.

The role of the media in this framework is key: the quality of the information framework, i.e. of the signals received by the agents, is indeed central for the efficiency of the political process. To understand why, one has to relax some assumptions of the very simple Condorcet framework. While Condorcet (1785) assumes exogenous signal acquisition, central is to explain why some agents choose to acquire information while others do not. Assume that only a fraction q of the agents acquired a signal and that among the informed agents, the fraction which observes the message $\sigma \in \{\sigma_A, \sigma_B\}$ in state σ is $\rho \in (.5, 1]$ (see e.g. Feddersen and Pesendorfer, 1996; Feddersen and Sandroni, 2006b,a). When ρ is close to .5 the message is a very noisy signal of the true state, while when ρ is close to 1, the message almost perfectly conveys the true state. The media enters this simple conceptual framework in two important ways: first, the share of informed agents q that decide to acquire a signal depends on the cost of information acquisition, i.e. on the cost (through their price or accessibility) of newspapers (if one focuses on print media); second, the quality of the signal ρ is an increasing function of the quality of the newspapers (see e.g. Chapter 1 of this dissertation). In such a framework, one can show that the information aggregation property of large elections improves as the quality of information increases and also depends on the cost of information acquisition.

The rest of the chapter presents the evolution of the sub-Saharan print media and discusses different business models for an informative press – an accessible high-quality press –, such an informative press being key for the information aggregation property of elections, i.e. for democracy.

5.3 The Historical Development of the African Media

Do sub-Saharan African newspapers follow the same "steps" of development than other newspapers?[11] For instance, will a "social history" of American newspapers such as the one of Schudson (1981) be of any help to understand the history of newspapers in other countries in the world? While we tend to think that newspapers in the West historically developed as a product either of the political world or the market economy[12], the study of the historical development of sub-Saharan African newspapers sheds a new light on the development of media markets. The sub-Saharan African case indeed highlights important aspects of what makes the media industry viable that have been overlooked in the existing literature.

The press in sub-Saharan Africa is relatively young when compared to the rest of the world. While the first newspapers in the West appeared in the 17th century[13] in France for

[11]Part of this section relies on the second chapter of this dissertation, co-authored with Valeria Rueda.

[12]According to Hallin and Mancini (2004, p.90), *"the media developed in Southern Europe as an institution of the political and literary worlds more than of the market. In Northern Europe and North America, the commercial bourgeoisie, whose success in a market economy depended on a steady flow of reliable information about trade, navigation, technology, and politics, played a key role in the development of the first newspapers."*

[13]There is an open debate in the literature on whether newspapers appeared in the non-Western world in the first place. While some researchers point out that in China for example, the Pekin Gazette dates back to the 8th century, others argue that such a publication cannot be considered as a newspaper and that newspapers did not exist in East Asian countries before they opened to the West.

example, the first newspaper was created in 1631 and the first daily in 1777 (Daubert, 2009); and the first "corantos", the forerunners of the modern newspaper, came out in the urban centers as early as 1607 in Amsterdam (Hallin and Mancini, 2004) – the first newspapers in sub-Saharan Africa did not appear before the beginning of the 19th century. The *Cape Town Gazette* appeared in South Africa in 1800 and the *Royal Gazette* in Sierra Leone a year later. The first truly indigenous press – the black Africa's press – was founded in Liberia in 1826 with the monthly *Liberia Herald* of Charles Force (Mytton, 1983), in Ghana in 1857 (the *West African Herald* – the first newspaper of an African from Africa) and in Nigeria in 1859 (*Iwe Irohin* – "The Newspaper").

Why is the press in sub-Saharan Africa so young? First and foremost because in order to produce newspapers, one needs economic and technological development, and in particular the printing press technology. In sub-Saharan Africa, Protestant missionaries – because they needed to print Bibles and educational material in order to spread their religious beliefs[14] – were the first both to import the printing press technology and to allow the indigenous population to use it (Woodberry, 2012). This early availability of the printing technology enabled the local development of a culture of writing and information diffusion. Thanks to early access to the printing press, local newspapers developed first in certain African regions and not in others.

Because Protestant missionaries made printing presses available to the native population, most of the first indigenous newspapers were printed and sponsored by mission centers.[15] The first newspaper intended for black readers, the *Umshumayeli Wendaba* ("Publishers of the News"), written in Xhosa, was published as an irregular quarterly in 1837 and printed at the Wesleyan Missionary Society in Cape Colony. The London Missionary Society and Methodist missions also produced the earliest journals aimed at the Tswana Christian

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[14] According to the principle of the Sola Scriptura central to the Protestant doctrine, every Protestant should be able to read the Bible.

[15] The study of a possible agenda of these newspapers is well beyond the scope of this chapter. However, it is important to highlight that these newspapers often provided spaces for intellectuals to discuss reform ideas; criticisms of colonization and statements in favor of slavery abolitions were part of these newspapers that may be viewed as the seeds for nationalist movements (see e.g. Woodberry, 2004).

community from their stations at Kuruman and Thaba'Nchu. *Mokaeri Oa Becuana, Le Muleri Oa Mahuku* ("The Teacher of the Bechuana, the Announcer of the News"), which started in 1857, is regarded as the oldest newspaper in the Tswana language (Switzer, 1984). *Isigidimi samaXhosa* ("The Xhosa Messenger"), the first African newspaper edited by Africans, was first released in 1876 and printed at the Lovedale Mission Press. Eight years later, in 1884, the English/Xhosa weekly *Imvo Zabantsundu* ("The African Opinion") was published. It was the first black-owned and controlled newspaper in South Africa (Switzer and Switzer, 1979).

The role played by Protestant missions in the introduction of the first newspapers is thereby key; strikingly, in regions where Protestant missions were less active, the first newspapers appeared only at the beginning of the 20th century and no indigenous newspapers were created before World War I. While by the end of the 19th century, about thirty-four newspapers had appeared in Sierra Leone, nineteen in the Gold Coast, nine in Nigeria[16] and one in the Gambia (Mytton, 1983), before the war, the printing presses were still mostly owned by the colonial powers in former French colonies. In these colonies, the only publications were religious or official publications; newspapers were made by and intended for Europeans (Daubert, 2009).[17] The first paper in Cote d'Ivoire to be owned and edited by an African, the *Eclaireur de la Cote d'Ivoire*, only appeared in 1935 (Mytton, 1983).[18] More importantly, this lag of more than one century in the timing of creation of the first indigenous newspapers appears as one the determinants of the differences in the current state of the newspaper industry in different sub-Saharan African countries. Newspapers take time to consolidate. At the time of independence, 88% of the former English colonies had a private press, against only 27% of the former French colonies (including Madagascar and Maurice)

[16]Between 1859 and 1937, a little more than four dozen newspapers were established in Nigeria (Omu, 1978).

[17]The situation is similar in former Portuguese colonies. In these colonies, the printing press was introduced only in 1854. In May 1854, was published the *Boletin do governo de Provincia de Moçambique*, an official newspaper. The first private newspaper, *O Progresso*, appeared in 1868 but was banned after the first issue, and one has to wait until 1870 to see published a new newspaper, *A Impresa* (Tudesq, 1995).

[18]The French discouraged the establishment of indigenous African publishing. All the early newspapers – such as *Le Réveil du Sénégalais* launched in 1886 and L'Union Africaine in 1896 – were published by Frenchmen (Mytton, 1983).

(Daubert, 2009).[19] Moreover, in most sub-Saharan African countries, the newly-established government tried to take control of the press after independence. These nationalizations did not succeed in countries where newspapers were well established, stable and independent before colonization (see e.g. Faye, 2008). In Nigeria, for instance, despite the coup d'état, the ensuing military regime and the development of a state-owned press, independent newspapers managed to survive. Similarly, even during Apartheid in South Africa, the black press and anti-Apartheid white-owned presses continued to exist. The *Daily Dispatch*, the *SASO Newsletter* or *The World* regularly diffused their anti-Apartheid stances. This was not the case in former French colonies. In the second chapter of dissertation (co-authored with Valeria Rueda), we find that proximity to a historical missionary settlement endowed with a printing press significantly increases newspaper readership today within regions located close to historical mission settlements.

What lessons can we draw from this brief overview of the history of sub-Saharan African newspapers? First, that there is a lot of persistence in reading habits. In the sub-Saharan African case, high circulation newspapers[20] may have developed in some countries while in other they do not because in some countries individuals became used to read newspapers before getting access to the radio, while in others – in which a private newspaper industry appeared after the radio – they do not. In the later, one may say that sub-Saharan African media have skipped the print newspapers phase of media development, the countries having gone straight from "nothing" to radio.

[19] In French West Africa (Afrique Occidentale Française – AOF) at the time of the independences, among the 132 "newspapers" registered in 1958, nearly half is made of handouts (trade-union, political or confessional bulletins) of random existence. Only a dozen can be considered as real newspapers sold on a regular basis and written by a permanent team (Perret, 2005).

[20] I cannot use the terminology "mass circulation newspapers" in the sub-Saharan African case; I come back to this point below.

5.4 The Current State of the African Media

The economics of a newspaper may be studied from different perspectives. In order to discuss the sub-Saharan African situation, this chapter relies on – and challenges – the different media system models developed by Hallin and Mancini (2004) in their path-breaking comparative study of news systems.[21]

Hallin and Mancini (2004), focusing on the Western world, distinguish three media system models:

1. The "Liberal Model", which prevails across the Britain, Ireland and North America and is characterized by a relative dominance of market mechanisms and of commercial media.

2. The "Democratic Corporatist Model", which prevails across northern continental Europe (Austria, Belgium, Denmark, Finland, Germany, the Netherlands, Norway, Sweden, and Switzerland) is characterized by a historical coexistence of commercial media and media tied to organized social and political groups, and by a relatively active but legally limited role of the state.

3. The "Polarized Pluralist Model", which prevails in the Mediterranean countries of southern Europe (France, Greece, Italy, Portugal and Spain) and is characterized by integration of the media into party politics, weaker historical development of commercial media, and a strong role of the state.

Their classification relies on four dimensions according to which media systems can usefully be compared in their view:

1. The development of media markets, with particular emphasis on the strong or weak development of a mass circulation press.

[21]Nor in Hallin and Mancini (2004) which consider eighteen advanced capitalist democracies in Western Europe and North America neither in their follow-up book focusing of the non-Western world (Hallin and Mancini, 2012) – to the exception of a chapter on South Africa –, the sub-Saharan African case is used to build insights on the economics of the media all around the world.

2. Political parallelism, that is, the degree and nature of the links between the media and political parties or, more broadly, the extent to which the media system reflects the major political divisions in society.

3. The development of journalistic professionalism.

4. The degree and nature of state intervention in the media system.

This chapter highlights that these dimensions – despite their general relevance – are not enough to understand the complexity of the sub-Saharan African situation as well as of other countries. In particular, one has also to take into account (i) the business model of the newspapers, and in particular their reliance on advertising revenues versus revenues from sales or from other sources; and (ii) the issue of the access to the media – that one tends to forget in developed countries but that is still a key issue in developing countries, as will appear clearly below.

A mass circulation press? As it appeared clearly above, the state of the press varies from countries to countries in sub-Saharan Africa – and some of these differences come from differences in the historical development of the media in these countries. Nonetheless, it is hard to argue that any of the sub-Saharan African countries have ever had a mass circulation press. There are two ways to approach this question. First, by looking at the aggregate newspaper readership at the country level. Second, by analyzing the number of newspapers and studying the readership of each newspaper.

Before moving further, it is important to have some basic orders of magnitude in mind about what mass newspaper readership means historically in Western democracies. Both in Europe and in Northern America, the rise of modern democracy and universal suffrage has come together with a state of affairs where at least half of the electorate – and usually as much as two thirds or three quarters – reads a newspaper on a daily basis. For instance, in France, the circulation – i.e. the number of daily copies sold – of local daily newspapers has been of the order of 20-25% of the electorate throughout the 1950-2010 period (and even more if one also takes into account national daily newspapers). The average number of readers per copy seems to have been relatively stable around 3, so this corresponds to a readership rate around 60-75% (Chapter 1). In the United States, existing historical evidence suggests similar magnitudes, and newspaper penetration tends to be even higher in Northern Europe.[22]

As compared to this standard, African newspaper readership at the aggregate country level varies from country to country but is everywhere very far from mass circulation.[23] According to the 2005 Afrobarometer surveys[24], on average only 33% of the individuals surveyed read a newspaper at least once a month (while 86% listen news on radio and 45% watch news on TV) in sub-Saharan Africa. A recent survey made by the Lumina Foundation in southern and middle-belt Nigeria finds that 13% of the individuals read a national newspaper every day (Fraser, 2008). The order of magnitude is the same for Ethiopia: 13% of the respondents to the ERIS Audience Survey Ethiopia 2011 said that they receive information from newspapers. In the sub-Saharan African country with the highest newspaper penetration, South Africa, 40% of the population read a newspaper at least once a week.[25] In Nigeria, depending on the surveys, newspapers achieved 20 to 40% penetration among the adult population.

The number of newspapers also varies widely from country to country, but a high number of newspapers does not always reflect a good state of the industry. In the Democratic Republic of Congo for instance, while there were close to 700 registered publications in

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[22]According to the World Association of Newspapers (World Press Trends), newspaper reach as a percentage of all adults is 76% in Sweden, 73% in Finland and 68% in Norway in 2012.

[23]This low readership level may be due in part to low literacy rates. If more than half of the population is illiterate (which is the case for example in Ethiopia), then one can hardly expect to observe a readership rate above 50%. I come back below to the issue of the access to the media.

[24]There are 17 sub-Saharan countries in these surveys: Benin, Botswana, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Nigeria, Senegal, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. Surveys are based on interviews conducted in the local languages from a random sample of either 1,200 or 2,400 individuals of voting age in each country. Overall, they cover approximately 21,000 individuals sampled to constitute representative groups at the national level.

[25]According to AMPS 2013 BA (July 2012 – July 2013), 29.4% of all adults aged 15 and over were reached by the average issue of all 22 daily newspapers monitored by the survey, 31.8% by the for weeklies, and 47.7% when consider all the AMPS newspapers. When also taking into account the magazines, this share increases to 63.6%.

2012, fewer than 250 appeared on a regular basis. And all these publications tend to have a very low circulation. The largest circulation newspaper – the private weekly newspaper *Le Soft* – has a circulation of only 2,500 copies. Even the largest dailies in Kinshasa such as *Le Phare*, *L'Avenir* and *Le Potentiel*, only print about 2,000 copies. In the same order of magnitude, Chad's only daily newspaper, *Le Progrès*, print 3,000 copies a day, and Chad's weekly and twice-weekly newspapers never sell more than 4,000 copies per edition. In Côte d'Ivoire, the government daily *Fraternité Matin* has the largest circulation with 13,000 to 16,000 copies sold per day in 2010, but most newspapers sell only between 2,000 and 10,000 copies per day. Ethiopia's biggest daily newspaper, the government daily *AddisZemen* has a print run of fewer than 13,000 copies. The privately owned weekly *Addis Admas* has an average print run of 21,000 to 25,000 copies; however, most titles in Ethiopia have small print runs of only about 3,000 copies. On the contrary, South Africa has "only" 43 daily, weekly and bi-weekly commercial newspapers but the *Daily Sun*, the South African daily newspaper with the largest circulation, has a circulation of nearly 300,000 copies a day and an estimated readership of 5,500,000 individuals.

It is hard to determine the minimum number of copies sold necessary for a newspaper to be profitable, in particular because it depends on the reliance of the newspaper on revenues from sales (versus revenues from advertising – which themselves are a function of the number and types of readers – or other sources), as well as on the production and distribution costs of the newspaper. Key for the analysis is the understanding of the business model of the newspaper industry.

The business model of newspapers Newspapers are businesses and are shaped by many economic factors. From the developed countries' perspective, newspapers rely mainly on revenues from sales and revenues from advertising, sometimes also on government subsidies. As it will appear clearly below, this has not always been the case – papers were not run as businesses in the United States before the end of the 19th century and relied strongly at that time on political parties and corruption – and everywhere in the world, including in developed countries, we still observe strong ties between newspapers and political parties or the government. This section highlights the extent of newspaper reliance on corruption in sub-Saharan Africa, which does not mean that this is an African characteristic; but the lack of advertising resources make corruption – in the broader sense – central for the survival of many sub-Saharan African newspapers. In the majority of the sub-Saharan African countries, the advertising market is indeed very tight and newspapers are thus unable to rely on advertising revenues. In Angola for example, advertising is scarce and there are few advertising agencies. Moreover, only long-established newspapers with a high-enough circulation and a constant identifiable readership can capture the few advertising resources.

Only in a few countries, the advertising market is growing. This is the case for example in Nigeria. According to mediaReach OMD Nigeria, the total money spent on advertising (for all media sectors combined) rose by more than 50% between 2000 and 2004 (from US$63.076 million to US$117.537 million). In Senegal, even if more slowly, the advertising market is also expanding rapidly because of the development of the private sector, with the creation of small businesses and bigger brands which need visibility. Similarly with South Africa's consumer boom, advertising has increased and newspapers have been able to charge higher advertising rates. Total advertising spending on newspapers increased by 44% between 2002 and 2005 (Nielsen Media Research cited in OMD, 2005). And the main newspapers are profitable in South Africa.

In the vast majority of the other sub-Saharan African countries, newspapers however tend not to be profitable, or at least not profitable in a classic way, when looking at revenues from sales and from advertising. The Vietnamese example is particularly relevant and may apply to a number of countries in sub-Saharan Africa: *"A thriving local newspaper sector in such countries might seem to reflect strong communities and emerging democracy – but not necessarily. (...) Extortion business, digging the dirt on local politicians and businesspeople, and asking to be paid not to publish it."* (Hallin and Mancini, 2012, p.201). In other words, many newspapers do not operate as conventional businesses. First, many newspapers – this is the case for example in Chad and in the Democratic Republic of Congo – survive on the generosity of politicians who dictate the publication schedule. Newspaper owners use their publications to gain social and political influence and tend to subsidize their newspapers from other sources of income. Second, many newspapers survive thanks to extortion and coupage: *"in the Democratic Republic of Congo, coupage journalism (literally, "taking a cut") is so institutionalized that there are standard rates. For example, $20-30 will buy a story from a radio journalist"* (Susman-Pena, 2012). Evidence of coupage exists in many other countries, for instance in Côte d'Ivoire (Waliyu, 2007). This practice is institutionalized not only from the point of view of the coupage rates, but also from the one of media owners. A large number of owners hire journalists without a contract, do not pay them a regular salary and expect them to earn a living by publishing news reports – journalists receiving cash payments for writing promotional pieces – or not (coupage) in exchange for money.

Paid journalism is also used in some countries by governments as a more subtle way than censorship to limit criticism. On the one hand, governments tend to withdraw public sector advertising from critical newspapers and inversely to reward publications which support the official line with advertising.[26] On the other hand, governments – this is the case for example in Mozambique – invite journalists to accompany officials on trips. Not only in these cases the government pays for the journalists' travel costs and accommodation but it also provides them with a per diem that is sometimes more than their monthly salary.

Hence many papers are not run as businesses. With low circulation figures and little advertising to support them, they do not make money. Or more precisely they make money with very little by way of conventional sales or advertising revenue. Again, reliance on "corruption", e.g. through disguised forms of advertisement, is not a sub-Saharan African specificity and sub-Saharan African newspapers do not intrinsically lack ethical standards and make the voluntary choice of corruption; but the extent of this phenomena is particularly important in sub-Saharan Africa because of the lack of other sources of revenues. The exchange in "My Fair Lady" among Henry Higgins, Colonel Pickering, and Alfie Doolittle, a Cockney dustman, quoted in Jones (2010, p.104), provides an interesting

[26] This is far from being specific to sub-Saharan African countries. In the case of Argentina between 1998 and 2007, DiTella and Franceschelli (2011) find for example that the more monthly government advertising, the less coverage of the government's corruption scandals in the four main newspapers.

light on this issue:

"Have you no morals, man?" says Pickering.

Doolittle shakes his head self-pityingly and replies, *"Can't afford them, governor. Neither could you if you was as poor as me."*

With low sales levels and a tight advertising market, newspapers have in a way no other choice that to rely on corruption to survive. Moreover, another key obstacle to the development of viable newspapers is the size of the operating costs: in nearly all sub-Saharan African countries, paper is expensive, operating budgets are high, there are scarce printing facilities and there is nearly no official government subsidies to newspapers. A necessary condition for newspapers to avoid extraction is thus economic growth and increase in consumption, which will lead to an increase in advertising revenues.[27] A second necessary condition is an increase in the access to newspapers.

Access to the media While the literature tends to focus on media freedom, access to the media is also of key importance. A free press that it is not accessible to citizens cannot be of great help in making governments more accountable. Yet in many sub-Saharan African countries the press is very urban because distribution outside the capital and the big cities is too costly for newspapers and there is a flagrant lack of transport facilities.[28]

In Benin and in Togo for instance, there is no modern newspaper distribution corporation. According to Faye (2008), Beninese and Togolese journalists, in order to sell their newspapers in rural areas, have to go early in the morning to bus stations and request from the so-called "bush taxi drivers" to deliver the copies to rural resellers. The risk born by newspapers in this improvised system is too high and tends to deter them to sell outside the big cities. On

[27] *"Ethics codes began when commercial success made them, as Doolittle would say, affordable. In the 19th and early 20th centuries, journalists typically took money to write favorable stories, and the concept of a conflict of interest was laughable. Reporters were usually paid badly, had little education, and were looked on as a raffish and unscrupulous brotherhood. Journalists worked in an atmosphere of dog-eat-dog competition, and bribing sources to get the jump on sensational scoops was a part of the game. But as newspapers became more prosperous, they also became more respectable."* (Jones, 2010)

[28] The question of media access is also relevant when considering radio and television. In many countries, people do not have access to television because they do not have electricity.

the contrary in Senegal, where there is a newspaper distribution corporation – l'Agence de Distribution de la Presse (ADP) – newspaper penetration in rural areas is higher, but the distribution network is still very sparse.

The weakness of the distribution system may be viewed as an inheritance of the colonial area. In many Francophone countries, a French company – Presstalis, the French media distribution company – has had for years a monopoly on the distribution network. Analyzing the extent to which the distribution network aims at protecting French interests is far beyond the goal of this chapter, but it is important to stress that many have argued that this network is often used as a form of censorship – not distributing a newspaper amounts to be the same thing that censoring its content.

Another important impediment to media access is linguistic diversity – this chapter abstracts from the literacy question which has already been considered extensively in the existing literature. People do not have access to newspapers because newspapers are written in a language they do not spoke. In Côte d'Ivoire, nearly all newspapers are written in French while more than 60 African languages are spoken. In Chad, the official languages are French and Standard Arabic, but very few people speak either of these as a first language. Nevertheless, French is the language of most of the print media. Similarly in Mozambique, while only 40% of the population speaks Portuguese, the main newspapers are published in this language.

Moreover, access to the media is limited by the prohibitively high price of the newspapers. In Côte d'Ivoire for instance, given the relatively high cover price of the main newspapers (around US$0.44, that has to be compared to an average daily per capita GDP lower than US$3), only affluent Ivoirians can afford to buy one on a regular basis, especially in the interior where purchasing power is lower. Similarly, in Chad or in the Democratic Republic of Congo – where newspapers cost at least US$1 each, i.e. half of the average daily per capita income – most people cannot afford to buy a newspaper. *Le Soft* in the Democratic Republic of Congo, the private weekly newspaper with the largest circulation, costs US$7 and thus only prints 2,500 copies a day. On the contrary, the success of the people press in

Senegal may be due to its low price (US$0.20) which makes it more affordable. Moreover, this prohibitively high price of newspapers may explain why according to sub-Saharan African surveys the ratio between newspaper readership and circulation varies between 10 and 20, while in other countries like France or the United States, the average number of readers per newspaper issue is lower than 3.

These limits to media access have to be taken into account in an analysis of a viable model for the press.

5.5 Toward a New Model of the Economics of the Media

It appears clearly from the previous section that with high levels of illiteracy, underdeveloped consumer markets – low sales and advertising revenues –, an inadequate technology infrastructure and high input prices, newspapers have no choice but to rely on corruption and extraction. The problem is that corruption prevents newspapers to play their role of potent check on corruption and to increase government accountability. Hence one has to think of different economic foundations of the media. In this section, I first discuss what I call the “advertising illusion", the idea that given that advertising has been the way out of corruption in the United States it should be the case in any other countries of the world. I then present alternative economic models for the press.

5.5.1 The Advertising Illusion

It has been widely documented – for example by Hamilton (2004) – that nonpartisan reporting and an independent press emerged as a commercial product in the 1870’s in the United States. At that time, advertising became an important way for companies with nationally and locally distributed brands to raise awareness of their products. Papers with larger audiences attracted more attention from advertisers. This incentivized newspapers to increase readership, drop overt political bias and proclaim their independence in uncovering news. In other words, advertising revenues created an independent press (see e.g. Gentzkow *et al.*, 2006; Petrova, 2011).

One may argue that the fact that the commercial advertising market is reportedly underdeveloped in most sub-Saharan African countries demonstrates that sub-Saharan African newspapers are still in their infancy, and that with the future growth of consumption and the advertising market, sub-Saharan African newspapers will follow the path of their North American predecessors. However this might not be the case, for at least two reasons. First because advertising funding sources for newspapers are shrinking all around the world. And second because this decline is not new. It is often improperly associated to the introduction of the Internet or the recent financial crisis, but advertising revenues in newspapers have decreased since the 1950's both for instance in the United States (Schiffrin, 2010) and in France (Martin, 2005). Advertisers opted for television well before the apparition of the Internet. In the United States, the share of advertising in newspapers in total media advertising has decreased from 26% in 1990 to 10% in 2009. In other words, as highlighted by McChesney and Nichols (2010), *"the economic downturn did not cause the crisis in journalism; nor did the Internet."*

Moreover, print advertising does not longer account for the lion's share of newspaper revenues, even in the United States where it now represents less than half of the total revenues (Newspaper Association of America). The share of advertising in the total revenues of national daily newspapers in France has similarly been decreasing since 2000, from nearly 60% of the total revenues to less than 40% today (Chapter 1).[29] Even in the few sub-Saharan African countries which have a growing advertising market and where advertising revenues are important today for the profitability of newspapers – Nigeria and South Africa – we observe a decreasing trend. In South Africa, there has been a dramatic decline in print revenues between 1997 and 2012, from 40 to 29% of the total advertising expenditures, in favor of both television and the Internet. Similarly, despite the increase in advertising expenditures in Nigeria, advertising expenditures in the press began to decrease in 2011; both the share of the press in total advertising expenditures and the amount of print

[29] Advertising revenues similarly represent less than 40% of the total revenues of French local daily newspapers.

advertising decreased.

In addition, note that the very large growth in advertising at the end of the 19th century in the United States was not only due to a growth in consumer spending, but to the development of what has been called “monopoly capital" (Baran, 1969). This type of capitalism, typified by large corporations competing in oligopolistic markets, is best exemplified by the United States. On average in the United States, advertising have accounted for over 2% of GDP in the 20th century. But there is no evidence pointing in the direction of a similar increase in sub-Saharan African in the forthcoming decades. Moreover, even in the United States, advertising is becoming a smaller portion of the sales effort while non-advertising marketing expenses – in particular direct marketing – are growing (McChesney et al., 2000). Hence not only the share of the press in total advertising is declining, but explicit media advertising may decline in the future.

This is a key point: in the long run, one needs to find a new business model for newspapers that does not depend so much on advertising revenues.[30] While one century and a half of American newspapers relying mainly on advertising leads us to think that it may be the Grail of the freedom of the press, not only it is no longer the case, but it might never be the case for newspapers in sub-Saharan African. If and when the growth of mass consumption and hence of advertising expenses finally takes place in Africa, it is very likely that it will only be to the benefit of television and the internet. From this point of view, sub-Saharan African newspapers have skipped the reliance on advertising revenues business model period of newspapers.

5.5.2 Perspectives for a New Business Model

In this last section, using the evidence from the economics of the sub-Saharan African media, I discuss perspectives for a new business model. This includes the following

[30] Another potential advantage – that I won't discuss here – of having media system relying less on advertising revenues would be that it may lead media to favor news over entertainment. A number of studies have indeed found – both theoretically and empirically – that media tends to produce more entertainment when they rely more on advertising.

issues: (i) the pros and cons of ownership concentration; (ii) the development of synergies between national and local newspapers; and finally (iii) the development of nonprofit media organization.

Ownership concentration Advocating for higher ownership concentration in the media sector may seem to be highly controversial. Media competition is indeed often viewed – with good reasons – as a guarantee for press freedom and diversity and de facto media monopoly is never a solution and raises the issue of media capture. However, chaotic proliferation of low-quality media outlets – as it has often happened in sub-Saharan African countries in the last decades, with very short-lived outlets – may be bad. Under certain conditions, an increase in media competition can lead to a decrease in both the quantity and quality of news provided – and so a decrease in government accountability (Chapter 1). With tight advertising markets and low consumer purchasing power as in many sub-Saharan African countries, a market can only support a limited number of media outlets, due to both the endogenous and exogenous fixed costs of news production.

If we further examine the example of South Africa, one of the reasons of the recent success – and growth – of the print media sector may come from concentration in ownership. Publishers have indeed been able to keep their costs down by sharing resources and editorial copy. The majority of South African newspapers are indeed owned by only four companies (Naspers Ltd, Johnnic Communications Ltd, Caxton and CTP Publishers and Printers Ltd, and Independent News & Media South Africa). Similarly in Guinea, though in a very different media environment with low circulation and few advertising revenues, the oldest and most respected independent weeklies, *Le Lynx* (7,000 copies a week) and *La Lance* (6,000 copies per week) are owned by the same publishing house. The Lynx-Lance group owns its own printing press and employs 54 people. The only large privately owned multi-media group in Mozambique, the Sociedade Independente de Comunicacões (SOICO), runs a TV station, a radio station, Mozambique's largest independent daily newspaper, *O Paı́s*[31], and a

[31] Which prints 30,000 copies per day.

monthly magazine, *Fama*. A team of about 20 journalists provides news for SOICO's media outlets. This may seem a small newsroom from the point of view of Western newspapers, but in fact it is a large one compared to the average number of journalists working in sub-Saharan African newspapers. *O País* can rely on such a newsroom – and provides relatively high-quality news – thanks to the economies of scale enabled by several media outlets owned by the same media company and thus sharing the same newsroom. Moreover the group has provincial offices with correspondents who provide news coverage for both the television and *O País* from cities in the interior.

Developing synergies between national and local newspapers Another way to take advantage of the increasing returns to scale that characterize the newspaper industry and moreover at the same time to increase media access, will be to develop synergies between national and local newspapers, between mass and small-scale media. As of today in sub-Saharan African countries, only community-based radio stations communicate in local languages in order to reach marginalized groups.[32] Newspapers also have to develop local content and languages. By doing so they will facilitate media access of an important share of the population which is, as I underlined above, de facto excluded from newspapers because of a language barrier, and increase their readership. But given the economies of scale involved in news production, local content should be developed by national newspapers publishing several local editions in local languages – editions distributed in rural areas –, rather than by a variety of very small local newspapers which cannot be viable from an economic view point (except of course if they chose to rely on extraction and corruption, which cannot be considered as a good business model for newspapers).

This business model of newspapers sharing their newsroom – whether they are owned by the same media company or not – may moreover be an interesting model for the future of the news industry beyond sub-Saharan Africa. In the United States for instance, the American Newspaper Preservation Act (NPA) (1970) – a broad antitrust exemption – permits

[32]Television stations also tend increasingly to do so.

qualifying newspaper competitors to enter into a joint operating agreement and to combine business operations (printing, delivery and advertising employees and expenses), thereby reducing costs and boosting profits (Greenberg, 2012). Ohio's eight largest newspapers[33], forming the "Ohio News Organization", share that way state, business, sports, arts, and entertainment news reporting, as well as various kinds of features, editorials, photographs, and graphics (Downie and Schudson, 2009). Similarly in France, daily local newspapers from the news company "EBRA" decided in 2013 to pool their national and international information pages through an agency based in Paris (Chapter 1).

Nonprofit media organizations Finally, there is an ongoing debate – in particular in Western countries – on the efficiency of direct government subsidies for the press, in particular because there is always a risk that subsidies may jeopardize newspapers' independence.[34] Given the weakness of many governments in sub-Saharan African countries, the issue of corruption and government accountability and the low level of public good provision, such subsidies may in any case not be relevant. However, an alternative to subsidies could be "philanthropy". Schizer (2011) proposes to provide a subsidy through the charitable deduction. Greenberg (2012) similarly defends the idea of indirect support via tax benefits by facilitating newspaper conversion to nonprofit status. Making independent nonprofit media as the centerpiece of the press system – possibly in some sub-Saharan African countries with the support of the international community – may indeed be an important step toward a viable business model of independent newspapers which will fully play their role of watchdogs.[35] Given the decline of advertising revenues and the high cost of producing high-quality news, profit margins will never be high again in the newspaper industry, neither in the Western

[33] *The Plain Dealer* in Cleveland, *The Akron Beacon Journal*, *The* (Canton) *Repository*, *The Columbus Dispatch*, *The* (Cincinnati) *Enquirer*, the *Dayton Daily News*, *The* (Toledo) *Blade*, and *The* (Youngstown) *Vindicator*.

[34] Even if there are various direct government subsidies in many European countries and these subsidies do not seem to have had a noticeably chilling effect on newspapers' willingness to print criticism of those governments.

[35] There is a long tradition of nonprofit journalism in the United States, from the creation of the Associated Press – which is cooperatively owned by the thousands of newspapers and broadcasting stations it serves – to newspapers such as the *Christian Science Monitor*, the *St. Peterburg Times* or the *Delaware State News*.

world nor in sub-Saharan Africa. A nonprofit model – with a commitment to journalism – has this advantage that a reduction of the editorial budgets won't be used as a systematic answer – as it is unfortunately too often the case today – to a decrease in profit margins. In my view, countries should also develop nonprofit news agencies that should be subsidized by the government.[36] Subsidizing nonprofit news agencies would be a way for government funding to apply uniformly across the newspaper industry.[37]

5.6 Conclusion

"[Newspapers] may have a mission, but they are also business, with all that implies." (Jones, 2010).

Newspapers are businesses and are shaped by many economic factors. These factors have to be taken into account when analyzing the economics of the newspapers.

But newspapers are particular businesses. They cannot be considered just as any firms. Information is a public good, but one that cannot be delivered by the government, an informative press being a check on government accountability. Hence a good business model for newspapers is one that guarantees both newspaper viability and independence, as well as access to newspapers.[38] One of the crucial lessons of this chapter is that advertising-dependent media systems may not be sustainable in the long run; and may never be a solution for many sub-Saharan African countries. Advertising revenues have historically been the principal source of income for daily newspapers, but they are declining everywhere.

It is thus necessary to think about a new business model. This chapter presents some perspectives for such a new model. It discusses the pros and cons of ownership concentration

[36] The three largest news agencies in the world are Associated Press, Reuters and "Agence France-Presse" (AFP). In France, government subscriptions to AFP are a way to subsidize news production by the agency.

[37] An important caveat that one has to keep in mind is nevertheless that such a nonprofit model of the media may not work in those sub-Saharan African countries that are "weak states". As stressed by Monga (2009), it is far from easy in weak states to *"disentangle pro-democratic activities by civil society groups from routine power struggle by political entrepreneurs who hide behind civic or charitable organizations to pursue an often unethical agenda"*. In such weak states, the move towards a nonprofit model of the media would perhaps have to be done more progressively, beginning first by a decrease in the tax barriers to media entry that exist today.

[38] The solution cannot be to have very costly newspapers reserved to an elite. Because an informative press useful to monitor public good delivery must be a mass-circulation one.

and argues in favor of the development of synergies between national and local newspapers as well as of the development of nonprofit media organizations. I hope it will provide food for thought for future research. There is an increasing demand for news content but the economic base of the newspapers – particularly so in sub-Saharan Africa but also all around the world – are fragile; we have to find a sustainable way to satisfy this demand.

African media did not follow the same development pattern as other parts of the world and is not in a satisfactory state – to say the least. At the present time, this is a liability for African democratic and economic development. But this can become an asset if Africa – probably the only continent with sustained population growth in the century under way – uses this opportunity to invent a novel model for offering information to new generations of readers, viewers and citizens.

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Appendix A

Appendix to Chapter 1

A.1 Data Sources

A.1.1 Newspaper Data

A.1.1.1 Number of Newspapers

To determine for each year between 1945 and 2012 the number of newspapers present in each French “départment"/county, I use various sources of information that I digitize and merge.

For the **1945-1958** period, I use as a first source of information Guillauma (1995) who lists all the political and general information newspapers that have been published in France over the period. I extract from this list all the local daily newspapers. I check the consistency of Guillauma data by using three other sources. First, the *Cahiers de L'Institut Français de Presse*, a standard publication from an important French institute of press studies. Second, data from Ministry of Information reports on the state of French newspapers, that I collect in the French national archives. Third, the *Annuaires de la Presse et de la Publicité*, an annual directory of French newspapers. Newspaper directories are standard sources for historical research on French newspapers, but have never been digitized before. They originated as a guide to potential advertisers and were intended to be complete.

For the **1959-2006** period, I use the *Annuaires de la Presse et de la Publicité* as the first source of information.

For the 2007-2012 period, I use a more recent directory of newspapers (*Tarif média. La première source d'information sur les médias*).

I always check the consistency of the data on the number of newspapers present in each French county by using circulation data (see below). I also check that this data is consistent with the information provided in history books on French newspapers (Kayser, 1963; Derieux and Texier, 1974; Guillauma, 1988; Le Floch and Sonnac, 2000; Albert, 2004; Martin, 2005; Eveno, 2008).

Newspaper Owners To determine the identity of newspaper owners, I use (i) studies by historians, especially Derieux and Texier (1974); (ii) the archives of *Le journaliste* (a quarterly periodical published by the *Syndicat National des Journalistes* (SNJ) – National Union of Journalists); (iii) the archives of the INA (*Institut National de l'Audiovisuel* – National Audiovisual Institute); (iv) the archives of the newspaper *Le Monde*; and (v) information provided on the website of the Graduate School of Journalism of Lille[1].

A.1.1.2 Newspaper Circulation and Readership

I collect information on aggregate newspaper circulation at the newspaper level; and on newspaper circulation in each county for newspapers circulating across nearby counties. I also collect information on aggregate readership.

Aggregate circulation For the period **1945-1959**, newspaper circulation data comes first from Albert (1989) which is a standard source of historical research on this topic. I digitize this data. I check its consistency and complete it by using archives data from the French Ministry of Information's reports on the state of French newspapers. I used three reports:

1. *"Tirage des quotidiens de province au printemps 1945"*(local newspapers circulation during the spring 1945). These tables are from a file called "Local press, Political and news

[1] http://esj-lille.fr/

publications". They originate from the French Ministry of Information's regional delegations in major cities and date from April 1945.

2. *"Tirage des quotidiens de province de 1945 à 1952"* (local newspapers circulation between 1945 and 1952). These tables provide for each city and year the average circulation of all the local newspapers published in the city.

3. *"Tirage des quotidiens de province de 1951 à 1958"* (local newspapers circulation between 1951 and 1959).

For the period **1960-1974**, I use French Ministry of Information's non-publicly available records in the National archives. Newspapers were asked by the Ministry of Information to report annually on revenues, expenses and circulation. I collect and digitize data by having direct access to their responses to these queries.

For the **1975-1978** period, I use data in paper format from "Proscop Media"[2] reports that I digitize. These reports are available in the French National Library.

Finally, for the period **1979-2012**, newspaper circulation data is available in digitized format from the OJD, which is the French press observatory whose aim is to certify circulation data.[3]

Circulation data with geographical dispersion For the **1945-1958** period, circulation data with geographical dispersion is from the French Ministry of Information's reports described above.

For the **1959-1988** period, circulation data with geographical dispersion in paper format is from "Opération Vérité", an annual survey on local newspaper circulation at the city level conducted by the *Centre d'Etude des Supports de Publicité* (CESP). The CESP is a French interprofessionnal association gathering the whole of the actors of the advertising market concerned with the study of the media audience (advertisers, agencies and councils media,

[2]The Proscop Institute is a firm specialized in market research and marketing and geostrategic consulting.

[3]http://www.ojd.com/

central merchandisings of space, advertising media and controls). Figure A.1 provides an example of this data.

I check the consistency of this data by using data on geographical dispersion from Proscop Media for 1968-1970, 1973, 1975-1978, 1980, 1981, 1983, 1985-1987, 1989, 1991 and 1996.

For the **1990-2012** period, circulation data with geographical dispersion is available in digitized format from the OJD.

Readership For the **1957-1992** period, the data on newspaper readership is from the CESP which publishes every five years between 1957 and 1967 and annually starting from 1968 a study of French newspaper readers (*Etude sur les lecteurs de la presse française*). The representative sample of the survey is drawn from all French people above 18 years old living in metropolitan France using electoral lists. It is a random sample including between 250,000 and 300,000 individuals depending on the years. The survey is conducted using a questionnaire whose main aim is to describe the behavior of French readers at the time of the survey. The main information provided is about the reading of a newspaper during the last period. The survey is available in paper format in the CESP. I digitize it for the following years: 1957, 1962, 1967, 1968, 1969, 1970, 1972, 1974, 1976, 1978, 1980, 1982, 1984, 1986, 1988, 1990 and 1992. Figure A.2 provides an example of this data.

For the **1996-2012** period, the data on newspaper readership is available in digitized format from the *Syndicat de la Presse Quotidienne Régionale* (SPQR – Local daily press syndicate).[4] This annual data is from audience studies conducted to measure newspaper readership.

A.1.1.3 Newspapers' Price, Expenses and Revenues

I collect annually for local daily newspapers between 1960 and 2009 a number of important economic indicators, namely sales, profits, value-added, operating expenses (payroll, inputs,

[4]There is a gap in the dataset for 1993-1995. To the extent of my knowledge there is no survey covering this period. The data is also missing for the year 2005 in which no survey was conducted.

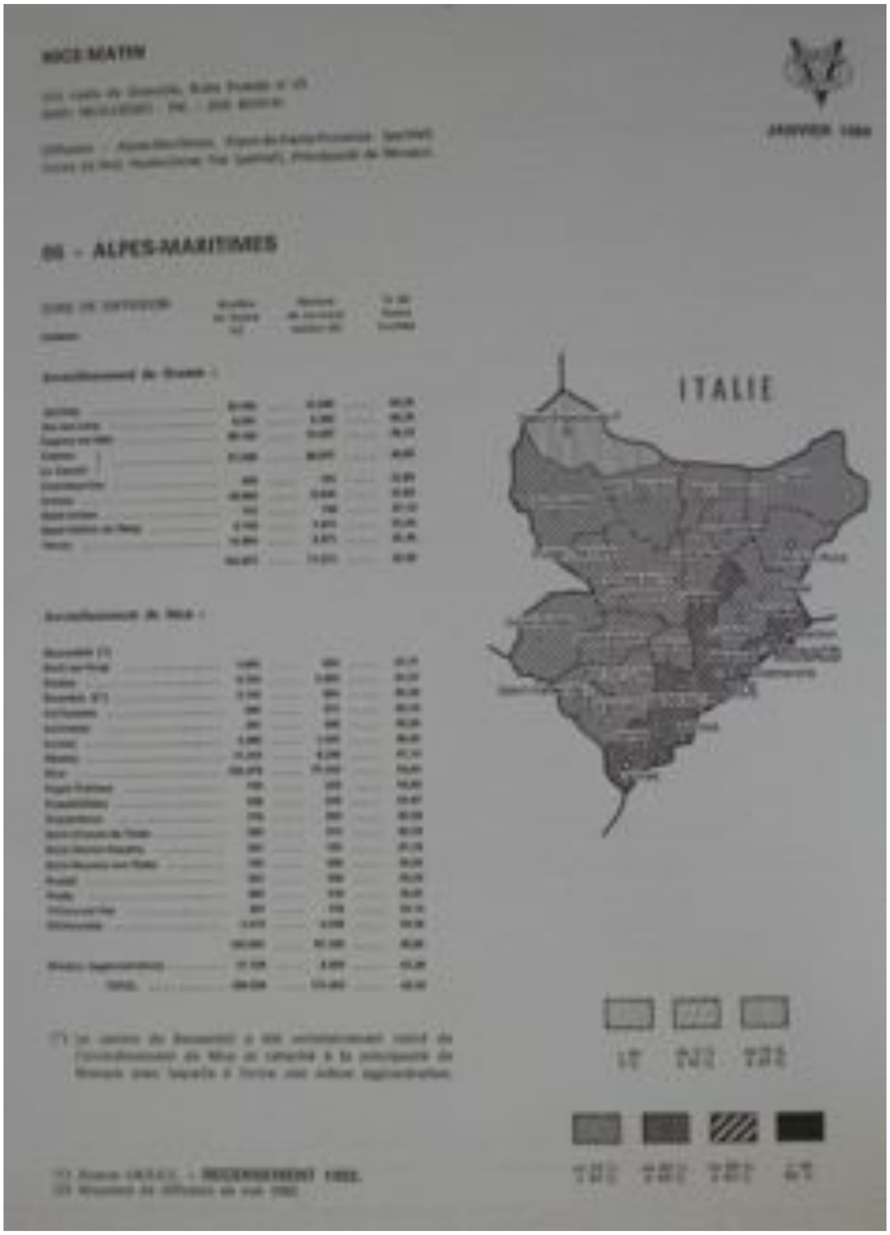
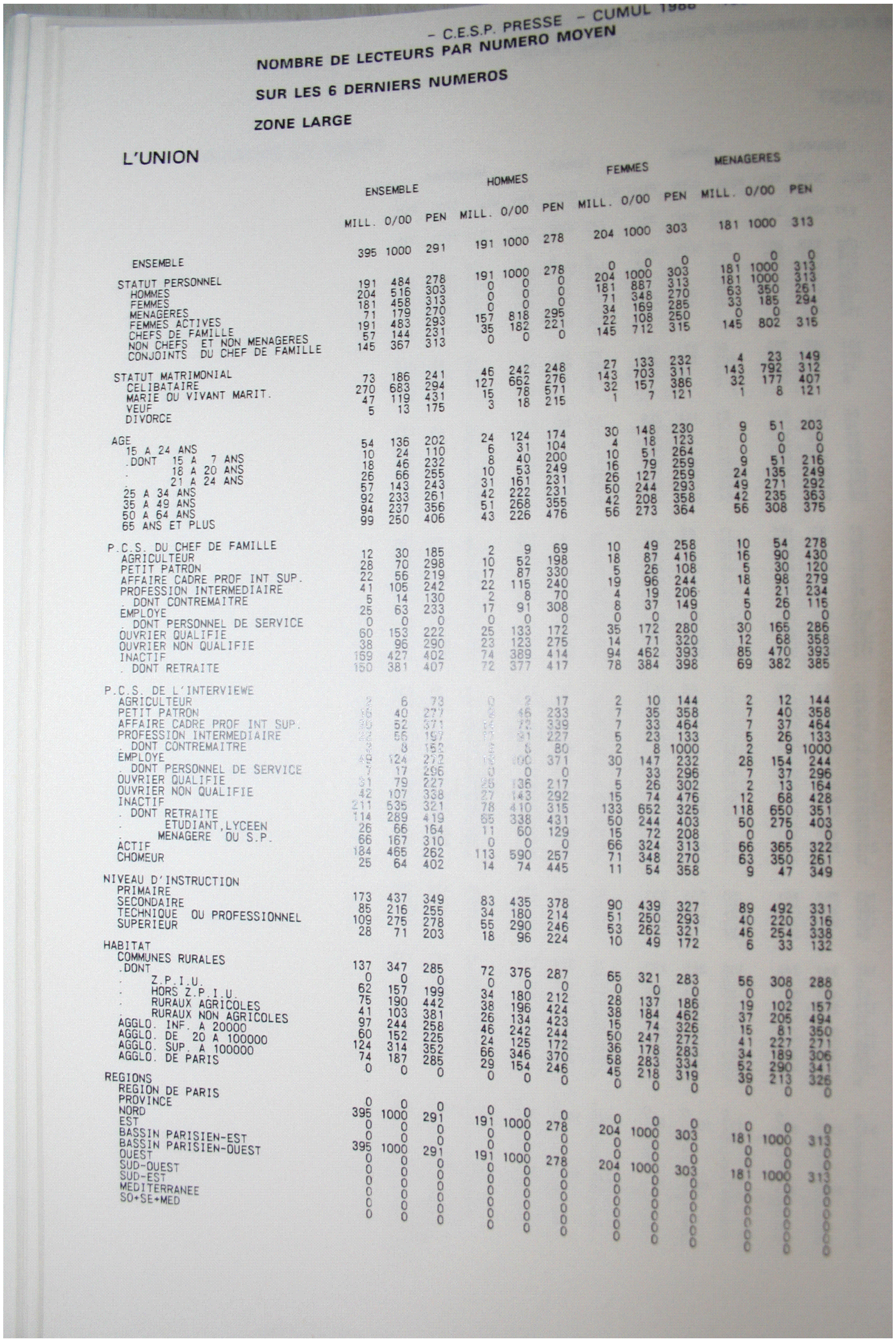


Figure A.1: *Example Showing the "Opération Vérité" Circulation Data in Paper Format*



– C.E.S.P. PRESSE – CUMUL 19[illegible]

NOMBRE DE LECTEURS PAR NUMERO MOYEN

SUR LES 6 DERNIERS NUMEROS

ZONE LARGE

L'UNION

	ENSEMBLE			HOMMES			FEMMES			MENAGERES		
	MILL.	0/00	PEN	MILL.	0/00	PEN	MILL.	0/00	PEN	MILL.	0/00	PEN
ENSEMBLE	395	1000	291	191	1000	278	204	1000	303	181	1000	313
STATUT PERSONNEL												
HOMMES	191	484	278	191	1000	278	0	0	0	0	0	0
FEMMES	204	516	303	0	0	0	204	1000	303	181	1000	313
MENAGERES	181	458	313	0	0	0	181	887	313	181	1000	313
FEMMES ACTIVES	71	179	270	0	0	0	71	348	270	63	350	261
CHEFS DE FAMILLE	191	483	293	157	818	295	34	169	285	33	185	294
NON CHEFS ET NON MENAGERES	57	144	231	35	182	221	22	108	250	0	0	0
CONJOINTS DU CHEF DE FAMILLE	145	367	313	0	0	0	145	712	315	145	802	315
STATUT MATRIMONIAL												
CELIBATAIRE	73	186	241	46	242	248	27	133	232	4	23	149
MARIE OU VIVANT MARIT.	270	683	294	127	662	276	143	703	311	143	792	312
VEUF	47	119	431	15	78	571	32	157	386	32	177	407
DIVORCE	5	13	175	3	18	215	1	7	121	1	8	121
AGE												
15 A 24 ANS	54	136	202	24	124	174	30	148	230	9	51	203
.DONT 15 A 7 ANS	10	24	110	6	31	104	4	18	123	0	0	0
. 18 A 20 ANS	18	46	232	8	40	200	10	51	264	0	0	0
. 21 A 24 ANS	26	66	255	10	53	249	16	79	259	9	51	216
25 A 34 ANS	57	143	243	31	161	231	26	127	259	24	135	249
35 A 49 ANS	92	233	261	42	222	231	50	244	293	49	271	292
50 A 64 ANS	94	237	356	51	268	355	42	208	358	42	235	363
65 ANS ET PLUS	99	250	406	43	226	476	56	273	364	56	308	375
P.C.S. DU CHEF DE FAMILLE												
AGRICULTEUR	12	30	185	2	9	69	10	49	258	10	54	278
PETIT PATRON	28	70	298	10	52	198	18	87	416	16	90	430
AFFAIRE CADRE PROF INT SUP.	22	56	219	17	87	330	5	26	108	5	30	120
PROFESSION INTERMEDIAIRE	41	105	242	22	115	240	19	96	244	18	98	279
. DONT CONTREMAITRE	5	14	130	2	8	70	4	19	206	4	21	234
EMPLOYE	25	63	233	17	91	308	8	37	149	5	26	115
. DONT PERSONNEL DE SERVICE	0	0	0	0	0	0	0	0	0	0	0	0
OUVRIER QUALIFIE	60	153	222	25	133	172	35	172	280	30	165	286
OUVRIER NON QUALIFIE	38	96	290	23	123	275	14	71	320	12	68	358
INACTIF	169	427	402	74	389	414	94	462	393	85	470	393
. DONT RETRAITE	150	381	407	72	377	417	78	384	398	69	382	385
P.C.S. DE L'INTERVIEWE												
AGRICULTEUR	2	6	73	0	2	17	2	10	144	2	12	144
PETIT PATRON	16	40	277	[illegible]	46	233	7	35	358	7	40	358
AFFAIRE CADRE PROF INT SUP.	20	52	371	14	72	339	7	33	464	7	37	464
PROFESSION INTERMEDIAIRE	22	56	197	17	91	227	5	23	133	5	26	133
. DONT CONTREMAITRE	3	8	152	2	8	80	2	8	1000	2	9	1000
EMPLOYE	49	124	272	19	100	371	30	147	232	28	154	244
. DONT PERSONNEL DE SERVICE	7	17	296	0	0	0	7	33	296	7	37	296
OUVRIER QUALIFIE	31	79	227	26	136	217	5	26	302	2	13	164
OUVRIER NON QUALIFIE	42	107	338	27	143	292	15	74	476	12	68	428
INACTIF	211	535	321	78	410	315	133	652	325	118	650	351
. DONT RETRAITE	114	289	419	65	338	431	50	244	403	50	275	403
. ETUDIANT, LYCEEN	26	66	164	11	60	129	15	72	208	0	0	0
. MENAGERE OU S.P.	66	167	310	0	0	0	66	324	313	66	365	322
ACTIF	184	465	262	113	590	257	71	348	270	63	350	261
CHOMEUR	25	64	402	14	74	445	11	54	358	9	47	349
NIVEAU D'INSTRUCTION												
PRIMAIRE	173	437	349	83	435	378	90	439	327	89	492	331
SECONDAIRE	85	216	255	34	180	214	51	250	293	40	220	316
TECHNIQUE OU PROFESSIONNEL	109	275	278	55	290	246	53	262	321	46	254	338
SUPERIEUR	28	71	203	18	96	224	10	49	172	6	33	132
HABITAT												
COMMUNES RURALES	137	347	285	72	376	287	65	321	283	56	308	288
.DONT	0	0	0	0	0	0	0	0	0	0	0	0
. Z.P.I.U.	62	157	199	34	180	212	28	137	186	19	102	157
. HORS Z.P.I.U.	75	190	442	38	196	424	38	184	462	37	205	494
. RURAUX AGRICOLES	41	103	381	26	134	423	15	74	326	15	81	350
. RURAUX NON AGRICOLES	97	244	258	46	242	244	50	247	272	41	227	271
AGGLO. INF. A 20000	60	152	225	24	125	172	36	178	283	34	189	306
AGGLO. DE 20 A 100000	124	314	352	66	346	370	58	283	334	52	290	341
AGGLO. SUP. A 100000	74	187	285	29	154	246	45	218	319	39	213	326
AGGLO. DE PARIS	0	0	0	0	0	0	0	0	0	0	0	0
REGIONS												
REGION DE PARIS	0	0	0	0	0	0	0	0	0	0	0	0
PROVINCE	395	1000	291	191	1000	278	204	1000	303	181	1000	313
NORD	0	0	0	0	0	0	0	0	0	0	0	0
EST	0	0	0	0	0	0	0	0	0	0	0	0
BASSIN PARISIEN-EST	395	1000	291	191	1000	278	204	1000	303	181	1000	313
BASSIN PARISIEN-OUEST	0	0	0	0	0	0	0	0	0	0	0	0
OUEST	0	0	0	0	0	0	0	0	0	0	0	0
SUD-OUEST	0	0	0	0	0	0	0	0	0	0	0	0
SUD-EST	0	0	0	0	0	0	0	0	0	0	0	0
MEDITERRANEE	0	0	0	0	0	0	0	0	0	0	0	0
SO+SE+MED	0	0	0	0	0	0	0	0	0	0	0	0

Figure A.2: *Example Showing the CESP Readership Data in Paper Format* taxes), operating revenues (revenues from sales and revenues from advertising), and the number of employees.

For the **1960-1974** period, the data is from the French Ministry of Information's non-publicly available records in the National archives described above (newspapers were asked by the Ministry of Information to report annually on revenues, expenses and circulation). Figure A.3 provides an example of this data.

For the **1984-2009** period, the data (in digitized format) is from the Enterprise Survey (*Enquêtes Annuelles d'Entreprise* – EAE) conducted by the French national institute for statistics (INSEE) and the files constructed for the tax regime (*Bénéfice Réel Normal* – BRN) by the Finance Ministry (*Direction Générale des Impôts* – DGI). I identify newspapers in the dataset using the French registry of establishments and enterprises ("Sirene"). For the newspapers not covered in the Enterprise Survey, I use information from the Bureau van Dijk's websites (in particular ORBIS).

Finally, the data on the number of journalists, covering the period 1999-2012, is from the local daily press syndicate (SPQR). I complete it using data I obtain directly from newspapers.[5]

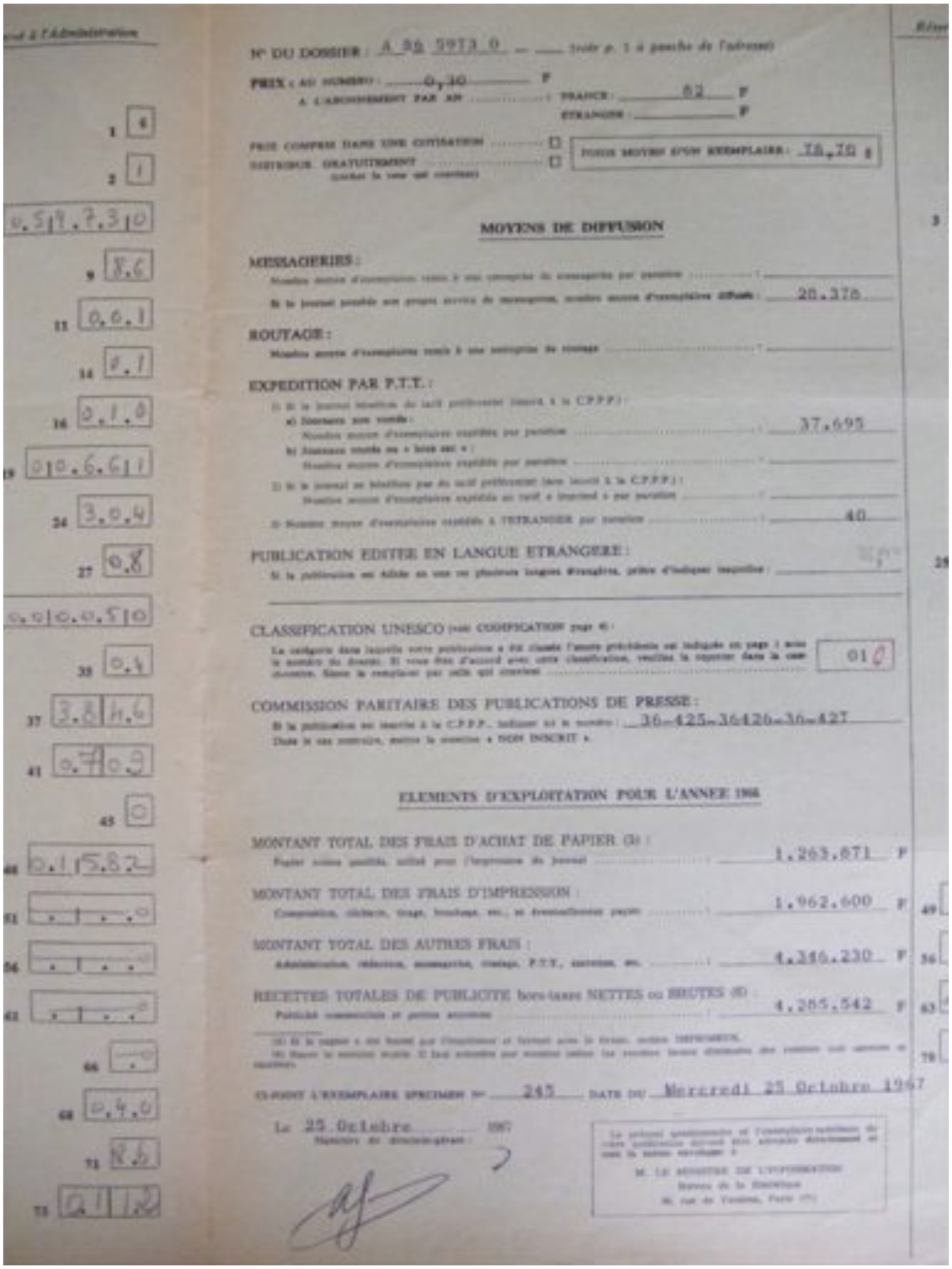
A.1.1.4 Newspapers' Content

Front pages Newspapers' front pages come from the SPQR website which publishes every day the "front pages of the day" of 54 local daily newspapers.[6] I download these front pages in ".pdf" format using an automated script, convert ".pdf" files in ".txt" files using an OCR software and count the number of words on each frontage.

Entire content I collect data on the entire daily content of each newspaper issue by using an automated script to retrieve for each day all the articles published in the issue. I download

[5]Contrary to the United States, there is no media directory available with information on the number of journalists by newspapers in France.

[6]http://www.pqr.fr/editeurs/les-unes-du-jour/



N° DU DOSSIER : A 56 5973 0

PRIX : AU NUMERO : 0,30 F

A L'ABONNEMENT PAR AN : FRANCE : 62 F

ETRANGER : F

POIDS MOYEN D'UN EXEMPLAIRE : 78,70 g

MOYENS DE DIFFUSION

MESSAGERIES : 28.378

ROUTAGE :

EXPEDITION PAR P.T.T. : 37.695

40

PUBLICATION EDITEE EN LANGUE ETRANGERE :

CLASSIFICATION UNESCO : 010

COMMISSION PARITAIRE DES PUBLICATIONS DE PRESSE : 36-425-36426-36-427

ELEMENTS D'EXPLOITATION POUR L'ANNEE 1966

MONTANT TOTAL DES FRAIS D'ACHAT DE PAPIER : 1.263.871 F

MONTANT TOTAL DES FRAIS D'IMPRESSION : 1.962.600 F

MONTANT TOTAL DES AUTRES FRAIS : 4.346.230 F

RECETTES TOTALES DE PUBLICITE hors-taxes NETTES ou BRUTES : 4.285.542 F

245 DATE DU Mercredi 25 Octobre 1967

Le 25 Octobre 1967

Figure A.3: *Example Showing the Expenses and Revenues Data in Paper Format* the data from two different websites which aggregate content from newspapers (Factiva[7] and Lexis-Nexis[8]).

Hard news and soft news To divide newspaper content between hard news and soft news, I use the information provided by the website Lexis-Nexis. When I retrieve the entire newspaper issues, I also retrieve all the metadata (tag) associated with each article on Lexis-Nexis (title, topic and subject). Figure A.4 provides an example of the format of the information I obtain from Lexis-Nexis. This example covers the May 8th, 2011 issue of the newspaper *Berry Républicain*. In this issue, they are 114 articles. The length of the article in this example is 330 words. The topic is sport; I classify this article as soft news.

Combining information from the title, topic and subject, I determine for each article its category. I create 13 different categories: agriculture, culture, economics, education, environnement, health, international, leisure activities, movies, “news in brief" (*faits divers*), politics, religion and sports.

I define as **hard news** the articles on agriculture, economics, education, environnement, international or politics.

I define as **soft news** the articles on culture, health, leisure activities, movies, “news in brief", religion or sports.

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[7]The data from Factiva covers 18 newspapers (beginning date in parentheses): *Berry Républicain* (2010-04-01); *Charente Libre* (2005-05-06); *Centre Presse Aveyron* (2006-09-01); *Est Républicain* (2008-02-27); *Indépendant* (2006-09-01); *Maine Libre* (2011-03-04);*Midi Libre* (2006-09-01); *Montagne* (2010-04-01); *Nouvelle République* (2011-01-12);*Ouest France*(2002-07-17); *Parisien* (2005-06-15); *Populaire du Centre* (2010-04-01);*Presse Océan* (2008-10-01); *Progrès* (2003-10-23); *République du Centre* (2011-05-02); *Sud Ouest* (2003-09-22); *Voix du Nord* (2011-02-01); *Yonne Républicaine* (2010-04-01).

[8]The data from Lexis-Nexis covers 21 newspapers: *Berry Républicain* (2010-03-22); *Centre Presse Aveyron* (2010-03-22); *Est Républicain* (2008-02-07); *Havre Libre* (2008-01-05); *Havre Presse* (2008-01-07); *Indépendant* (2007-05-11); *Journal Du Centre* (2010-03-22); *Maine Libre* (2011-09-05); *Midi Libre* (2006-11-01); *Montagne* (2010-03-22); *Nouvelle République* (2004-03-23); *Ouest France*(2006-04-20); *Paris Normandie* (2004-09-02); *Parisien* (2006-12-20); *Populaire du Centre* (2010-03-22); *Presse Océan* (2010-12-08); *Progrès de Fécamp* (2008-01-022); *Sud Ouest* (1994-05-07); *Tégramme (2002-02-01)*; *Voix du Nord* (2009-09-14); *Yonne Républicaine* (2010-03-22).


112 of 114 DOCUMENTS

Le Berry Républicain

Dimanche 8 Mai 2011
Cher Edition

SPORT

Les Biarrots ont tremblé jusqu'au bout

RUBRIQUE: SPORTS CHER; CLERMONT-FERRAND

LONGUEUR: 330 mots

ENCART: Biarritz s'est qualifié pour la phase finale du Top 14 pour la première fois depuis 2007 grâce à sa pénible victoire (22-18) à Bourgoin, déjà condamné à la descente en Pro D2 mais qui a fait trembler les Basques jusqu'au bout pour des adieux émouvants à l'élite du rugby national.

Le BO, qui n'avait plus atteint la phase finale du Top 14 depuis 2007, devra se déplacer à Clermont en match de barrage.

Les Basques ont échoué à obtenir ce barrage à domicile faute d'avoir pris le point de bonus offensif, objectif de leur déplacement dans l'Isère.

Figure A.4: *Example Showing the Format of the Lexis-Nexis Data*

Table A.1: *French Local Juridictions, Descriptive Statistics (2008)*

	Région *State*	Département *County*	Canton	Cities	Cities over 9,000 inhabitants
Number	22	96	3,883	36,570	1,011
Average population (nb)	2,839,500	650,719	16,088	1,722	61,789
Average area (km^2)	24,865	5,698	141	14.88	541

Sources: French national institute for statistics (INSEE).

A.1.2 French Voting System, Electoral Data and Demographic Controls

Local juridictions France is organized in six different levels of local juridictions: (i) *régions* (states); (ii) *départements* (counties); (iii) arrondissements; (iv) cantons (administrative districts); (v) *"intercommunalités"* (intercommunal consortium); and (vi) cities. Four levels correspond to electoral circumscriptions: (i) "régions"/states (regional elections); (ii) "départements"/counties (legislative elections); (iii) cantons (cantonal elections); and (iv) cities (mayoral elections).

A "départment"/county is a French administrative division. There are 101 French counties. The median land area of a county is 2,303 sq mi, which is slightly more than three-and-half times the median land area of a county of the United States. There are 36,570 cities in metropolitan France. There are 2,282 cities with more than 3,500 inhabitants outside the area of Paris. Table A.1 presents descriptive statistics on local juridictions.

Voting system The French voting system for local (mayoral) elections is the two-round list system with proportional representation (*"scrutin de liste à deux tours avec représentation proportionnelle"*). For cities with more than 3,500 inhabitant – which are the focus of this paper –, the system functions as follows: if a list obtains the absolute majority in the first round, then a number of seats equal to half of the available seats is attributed to this list. The other seats are shared between all the other lists following the proportional representation with the highest averages method. If no list obtains the absolute majority in the first round, then a second round takes place. The only lists that can take part in this round are the ones which obtained more than 10% of the recorded votes in the first round. A number of seats equal to half of the available seats is attributed to the list which obtains most votes and the other sears are shared between all the other lists following the proportional representation with the highest averages method.

Mayoral elections take place in France every six years.

Electoral data Between 1947 and 2008, 11 local elections took place: in 1947, 1953, 1959, 1965, 1971, 1977, 1983, 1989, 1995, 2001 and 2008.

Before 1983, data on French mayoral elections have never been digitized. I construct the first electronically available dataset on French local elections results at the city level between 1945 and 1982, using official data sources in paper format.

For the **1947 and 1953 elections**, I digitize data from the National archives in Paris (available in various boxes beginning with shelf mark "F/1cII/"). The data covers all the cities with more the 2,500 inhabitants. Figure A.5 shows an example of this electoral data (for the 1947 election).

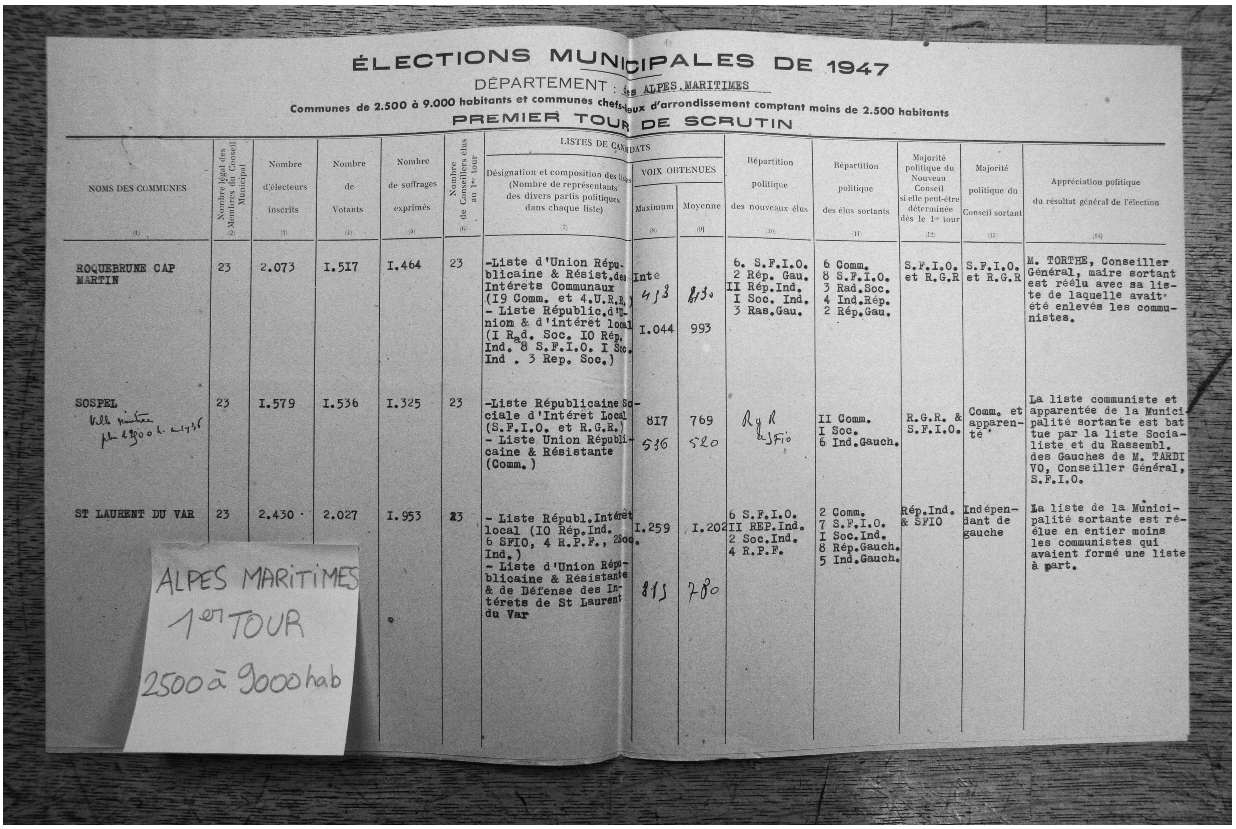
For the **1959, 1965, 1971, and 1977 elections**, I digitize data from the newspaper *Le Monde*. This information is available only for cities with more than 9,000 inhabitants. I supplement the 1959 data for cities under 9,000 inhabitants using data from the National archives.

For the **1983, 1989, 1995 and 2001 elections**, I use the data from the *Centre de Données Socio-Politiques* (CDSP) of Science-Po Paris for all the cities over 3,000 inhabitants.

Finally, for the **2008 election**, the data is available in digitized format from the Interior ministry for all the cities over 3,500 inhabitants.

Demographic Data City-level demographic data from the French census is available in electronic format from the French national institute for statistics (INSEE) website for 1968, 1975, 1982, 1990, 1999, 2009 and 2010.[9] The 1962 census data is from the *Centre Maurice*

[9] http://www.insee.fr/fr/bases-de-donnees/default.asp?page=statistiques-locales.htm



ÉLECTIONS MUNICIPALES DE 1947

DÉPARTEMENT : des ALPES.MARITIMES

Communes de 2.500 à 9.000 habitants et communes chefs-lieux d'arrondissement comptant moins de 2.500 habitants

PREMIER TOUR DE SCRUTIN

NOMS DES COMMUNES (1)	Nombre légal des Membres du Conseil Municipal (2)	Nombre d'électeurs inscrits (3)	Nombre de Votants (4)	Nombre de suffrages exprimés (5)	Nombre de Conseillers élus au 1er tour (6)	LISTES DE CANDIDATS: Désignation et composition des listes (Nombre de représentants des divers partis politiques dans chaque liste) (7)	VOIX OBTENUES: Maximum (8)	VOIX OBTENUES: Moyenne (9)	Répartition politique des nouveaux élus (10)	Répartition politique des élus sortants (11)	Majorité politique du Nouveau Conseil si elle peut-être déterminée dès le 1er tour (12)	Majorité politique du Conseil sortant (13)	Appréciation politique du résultat général de l'élection (14)
ROQUEBRUNE CAP MARTIN	23	2.073	I.517	I.464	23	-Liste d'Union Républicaine & Résist.des Intérets Communaux (I9 Comm. et 4.U.R.R.) - Liste Républic.d'Uniom & d'intérêt local (I Rad. Soc. IO Rép. Ind. 8 S.F.I.O. I Soc. Ind . 3 Rep. Soc.)	Inté 413 I.044	993	6. S.F.I.O. 2 Rép. Gau. II Rép.Ind. I Soc. Ind. 3 Ras.Gau.	6 Comm. 8 S.F.I.O. 3 Rad.Soc. 4 Ind.Rép. 2 Rép.Gau.	S.F.I.O. et R.G.R	S.F.I.O. et R.G.R	M. TORTHE, Conseiller Général, maire sortant est réélu avec sa liste de laquelle avait été enlevés les communistes.
SOSPEL	23	I.579	I.536	I.325	23	-Liste Républicaine Sociale d'Intérêt Local (S.F.I.O. et R.G.R.) - Liste Union Républicaine & Résistante (Comm.)	817 536	769 520	RgR et SFio	II Comm. I Soc. 6 Ind.Gauch.	R.G.R. & S.F.I.O.	Comm. et apparenté	La liste communiste et apparentée de la Municipalité sortante est battue par la liste Socialiste et du Rassembl. des Gauches de M. TARDIVO, Conseiller Général, S.F.I.O.
ST LAURENT DU VAR	23	2.430	2.027	I.953	23	- Liste Républ.Intérêt local (IO Rép.Ind. 6 SFIO, 4 R.P.F., 2Soc. Ind.) - Liste d'Union Républicaine & Résistante & de Défense des Intérêts de St Laurent du Var	I.259 815	I.202 780	6 S.F.I.O. II REP.Ind. 2 Soc.Ind. 4 R.P.F.	2 Comm. 7 S.F.I.O. I Soc.Ind. 8 Rép.Gauch. 5 Ind.Gauch.	Rép.Ind. & SFIO	Indépendant de gauche	La liste de la Municipalité sortante est réélue en entier moins les communistes qui avaient formé une liste à part.

Figure A.5: *Example Showing the Turnout Data in Paper Format*

Halbwachs.[10]

First, the census provides information on the total population, and on the share of the population by age group.

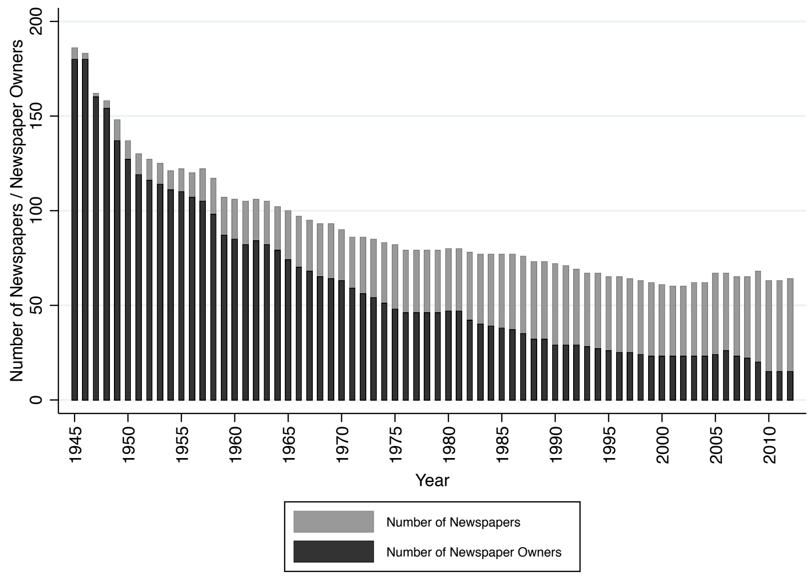
Second, the census provides information on the share of the population by occupation. Individuals (the working population between 15 and 64 year old) are classified into 6 different socio-economic groups:

1. Farmers;
2. Artisans, shopkeepers and company managers (*"artisans-commercants-chefs d'entreprises"*);
3. Senior executives and knowledge workers (*"cadres et professions intellectuelles supérieures"*);
4. Intermediate occupations (*"professions intermédiaires"*);
5. Employees;
6. Laborers.

Third, the census provides information on the share of the population by degree. Individuals above 15 years old are classified into 6 different education degrees:

1. No diploma;
2. "Certificat d'études primaires" which is a diploma awarded at the end of elementary primary education in France (which was officially discontinued in 1989);
3. "BEPC" or "brevet" which is a diploma given to French pupils at the end of the "3ème" (which corresponds to year 10 or ninth grade);
4. "Certificat d'aptitude professionnelle" (CAP) or "brevet d'études professionnelles" (BEP) which are secondary and vocational education diplomas;
5. "Baccalauréat" which is an academic qualification taken at the end of the lycée (secondary education) and the main diploma required to pursue university studies;

[10]http://www.cmh.ens.fr/greco/adisp.php



Notes: The data was constructed by the author using various sources described in details in this Appendix.

Figure A.6: *Total Number of Local Daily Newspapers by Year in France*

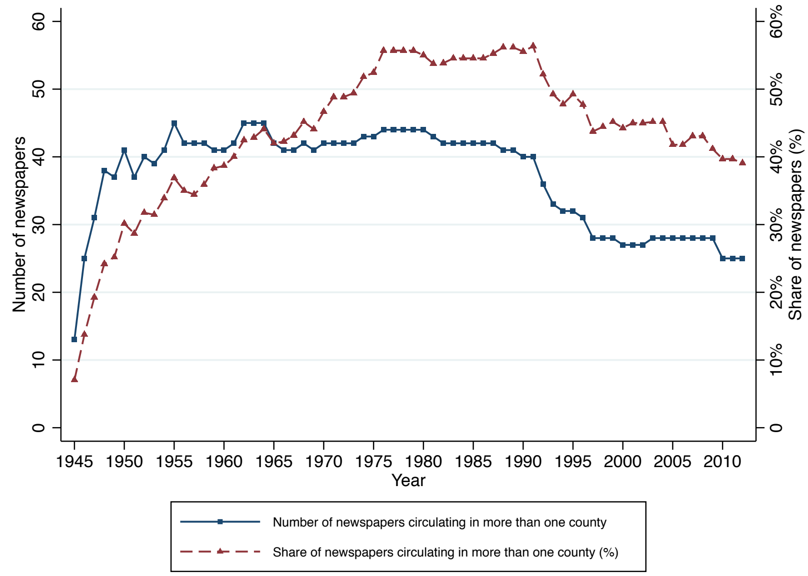
6. Higher (post-secondary) education.

I digitize data for the 1936, 1946 (INSEE, 1947) an 1954 (INSEE, 1958) censuses from original publications by the French national institute for statistics. However, I only obtain information on the size of the population and the share of the population by age group for this time period.

A.2 The Local Daily Newspaper Industry in France, an Overview

In this section, I give an overview of my data and of the evolution of the local daily newspaper industry in France between 1945 and 2012.

Figure A.6 shows the total number of newspapers by year in France. This number decreases strongly between 1945 and 2012. There are 186 local daily newspapers in 1945 and 64 in 2012.

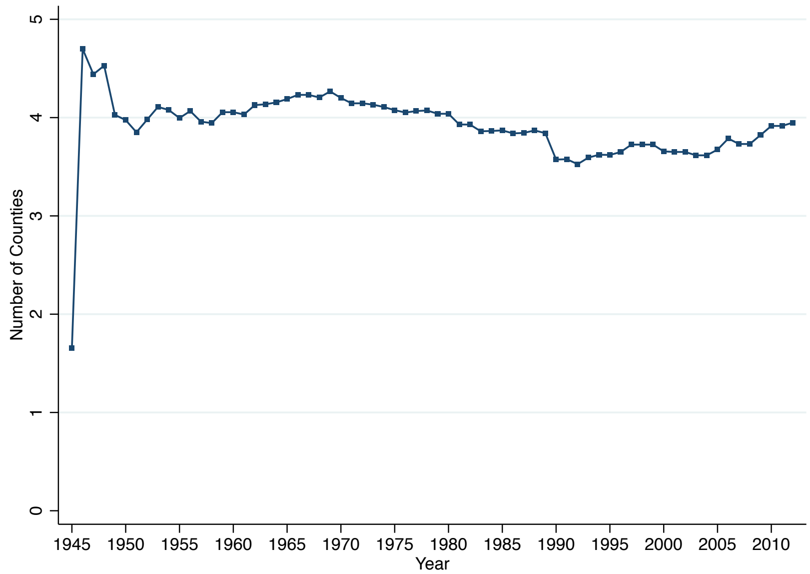


Notes: The data was constructed by the author using various sources described in details in this Appendix.

Figure A.7: *Newspapers Circulating in More than One County*

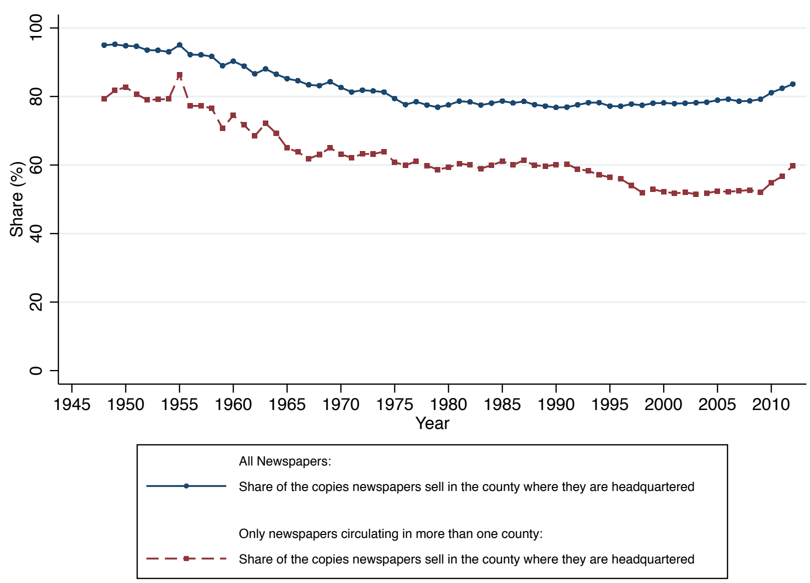
Circulation across nearby counties Despite this decrease, it is important to underline that between 1945 and 2012 there are nearly as many entries than exits. This comes from the fact that many newspapers circulate across nearby counties. In Figure A.7 I report the number (and the share) of newspapers circulating in more than one county. In 1950 (respectively 2000), 42 (27) newspapers over a total of 137 (61) are circulating in more than one county. This represents respectively 30% and 44% of the total number of newspapers in France at the time. On average, these newspapers circulate across 4 counties in 1950 (3.7 in 2000) as shown in Figure A.8.

Newspapers sell on average 85% of their copies in the counties in which they are headquartered. This ratio decreases strongly over time, from 98% to 73% in 2000 as shown in Figure A.9. It is below 55% if one only considers newspapers circulating in more than one county. This decrease may be due to improvements in transportation technology. Moreover, counties in which at least one newspaper is headquartered gets on average only 70% percent of their copies from in-county newspapers.



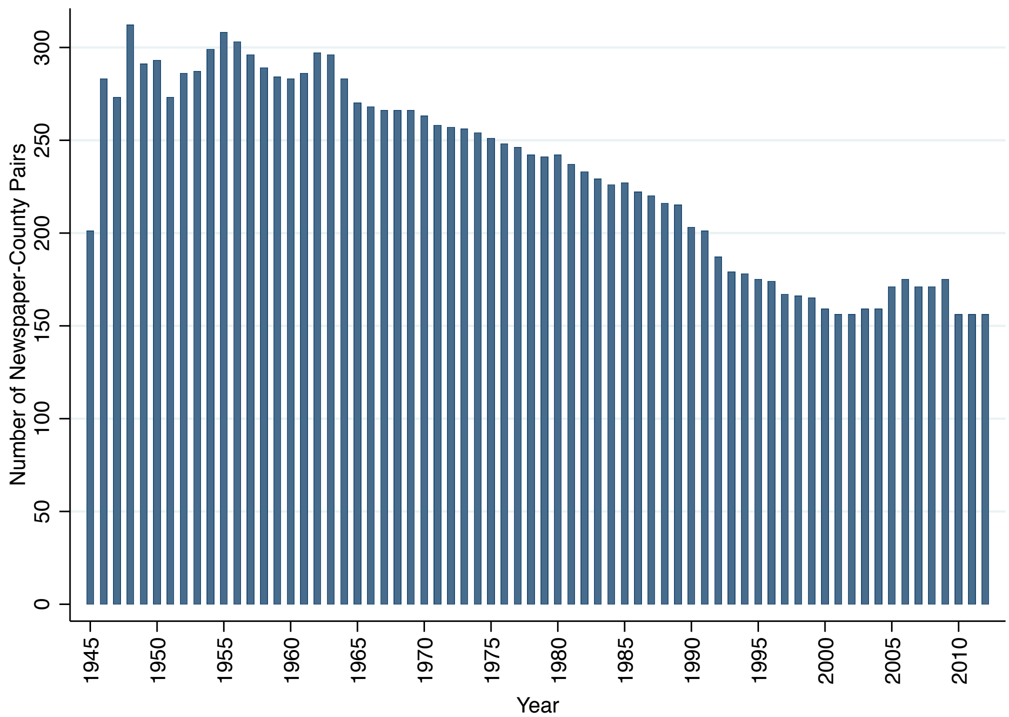
Notes: The data was constructed by the author using various sources described in details in this Appendix.

Figure A.8: *Average Number of Counties across which Newspapers Circulating in More than one County Circulate*



Notes: The data was constructed by the author using various sources described in details in this Appendix.

Figure A.9: *Share of their Copies Newspapers Sell in the Counties in which they are Headquartered*



Notes: The data was constructed by the author using various sources described in details in this Appendix.

Figure A.10: *Total Number of Newspaper-County Pairs by Year in France*

Newspaper-county pairs Entries can thus come either from the “creation" of new newspapers, or from the expansion of existing newspapers in nearby counties.[11] Figure A.10 shows the total number of newspaper-county pairs by year in France. This number decreases between 1945 and 2012 but is still above 150.

Over this period, I observe a total of 276 county-years with net entry and 361 county-years with net exit. Figure A.11 shows for each year the number of counties with net newspaper entry (upper figure A.11a) and the number of counties with net newspaper exit (bottom figure A.11b). The high number of entries/exits between 1945 and 1955 comes from the 1944-1945 tabula rasa of the past in the newspaper industy described in more details in the article (Section 1.4.1), with the entry of a lot of new titles and the rapid exit of a number

[11] My sample includes a total of 264 newspapers and 630 newspaper-county pairs.

of these new papers whose owners are inexperienced. Between 1955 and 2012, there are 79 county-years with net entry and 22 county-years with net exit.

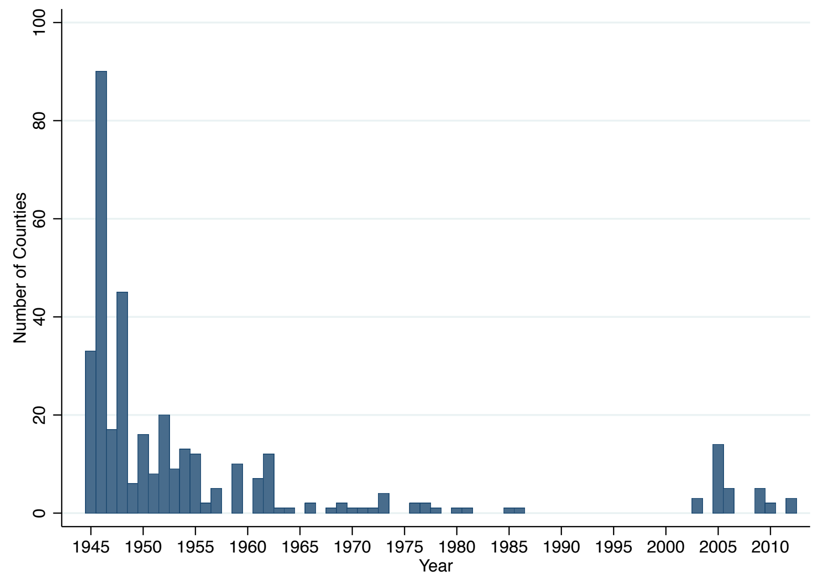
Figure A.12 shows the average number of local daily newspapers in a county by year. On average, in 1960, there are 3.3 newspapers circulating in each French county. In 2003, the first free daily newspapers appear in France. The figure shows the evolution of the number of newspapers/owners with (blue line with circles) and without (red dashed line with plus) these free newspapers.

The size of the local daily newspaper industry Figure A.13 shows the evolution of the aggregate circulation of local and national daily newspapers. The total circulation of local daily newspapers in France varies between 9 million copies at the beginning of the period and around 6 million today. Local newspapers are a key provider of information over the 1945-2012 period. In comparison, the circulation of national newspapers (including the Paris area) is below 2 million. If one only focus on the circulation of general information newspapers (dropping sport and financial newspapers) outside Paris, then it is below one million.

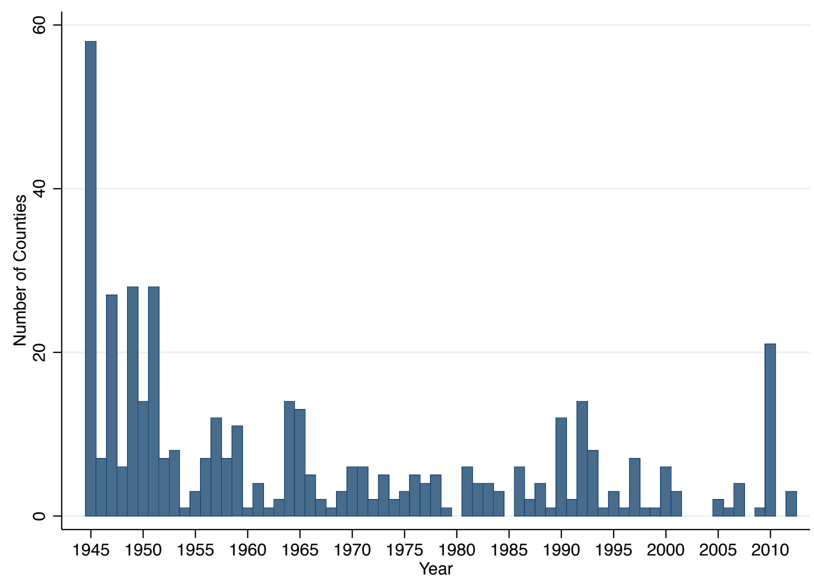
However, it is important to underline that if in aggregate terms the circulation of local newspapers is much higher than the circulation of national newspapers, the average total circulation of a given national newspaper is higher than the average total circulation of given local newspaper. National newspapers are on average bigger than local newspapers, but there are few of them.[12] Figure A.14 shows the evolution of the average total circulation of a local and a national newspaper. It varies around 200,000 copies for national newspapers, and its just below 100,000 copies for local newspapers.

Figure A.15 shows the evolution of the average total circulation of a local daily newspaper in a county. The average number of copies decrease varies between 30,000 and 40,000 during the period 1945-2012 (left axis). This number represents 50% of the eligible voters in 1945,

[12]There are only 6 general information national newspapers as of today (*Aujourd'hui en France*; *La Croix*; *Le Figaro*; *L'Humanité*; *Libération*; *Le Monde*), to which one can add 7 sport newspapers (*L'Equipe* and 6 dedicated horse racing newspapers: *Bilto*; *La Gazette des Courses*; *Paris Courses*; *Paris Turf*; *Tiercé Magazine*; *Week-End*) and 1 financial newspapers (*Les Echos*).



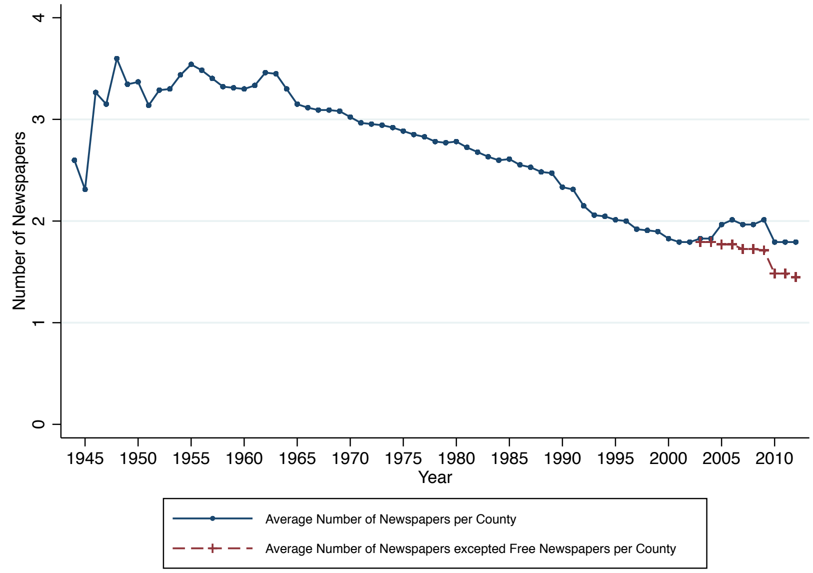
(a) *Number of Counties with Net Entry*



(b) *Number of Counties with Net Exit*

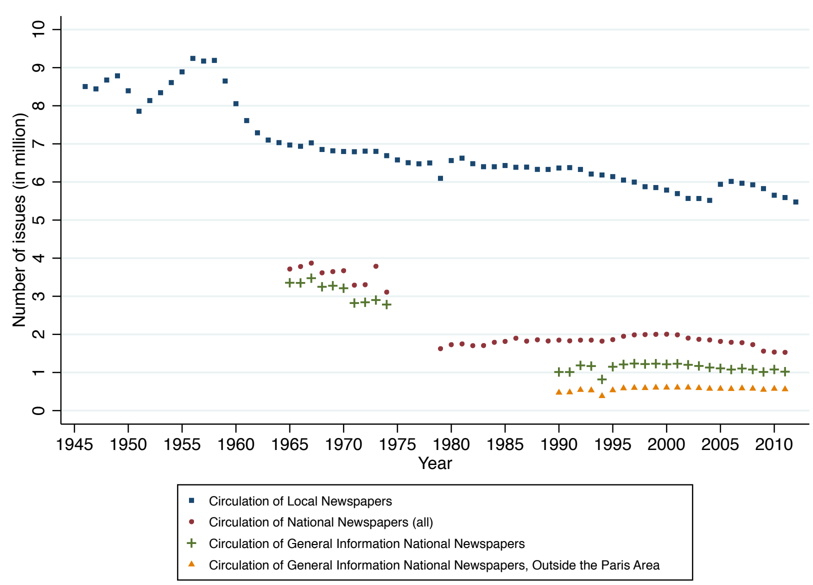
Notes: The figure shows for each year the number of counties with net newspaper entry (upper figure A.11a) and the number of counties with net newspaper exit (bottom figure A.11b). The data was constructed by the author using various sources described in details in this Appendix.

Figure A.11: *Number of Counties with Net Newspaper Entry / Net Newspaper Exit by Year*



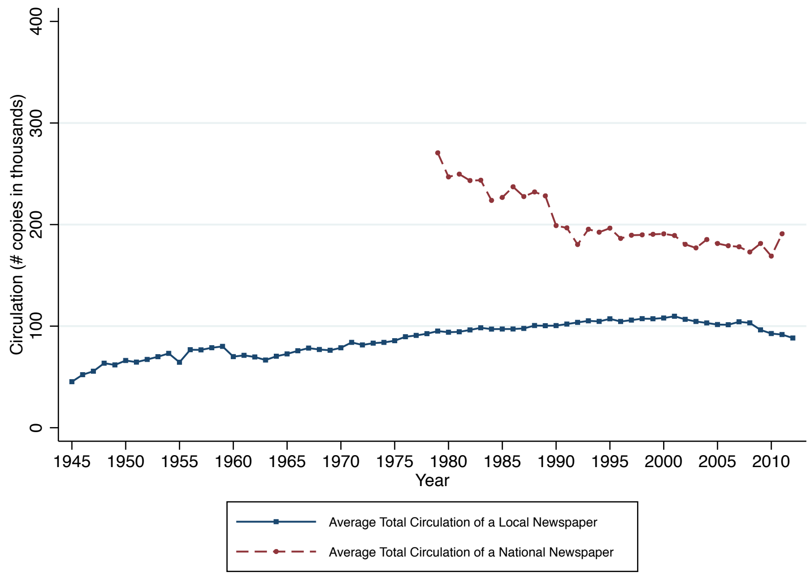
Notes: The data was constructed by the author using various sources described in details in this Appendix.

Figure A.12: *Average Number of Daily Newspapers in a County by Year*



Notes: The figure was constructed by the author using the circulation data described in details in this Appendix.

Figure A.13: *Aggregate Circulation, Local and National Newspapers*

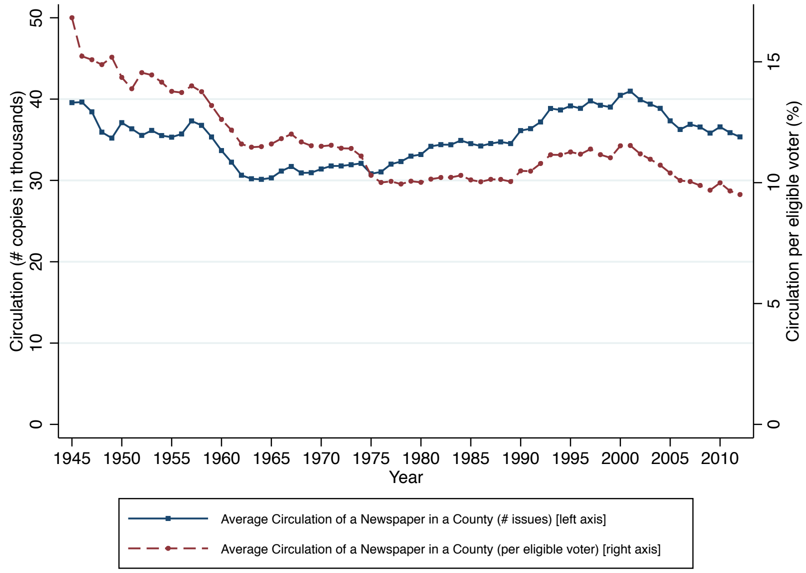


Notes: The figure was constructed by the author using the circulation data described in details in this Appendix.

Figure A.14: *Total Circulation of a Newspaper, Local and National Newspapers (Average)*

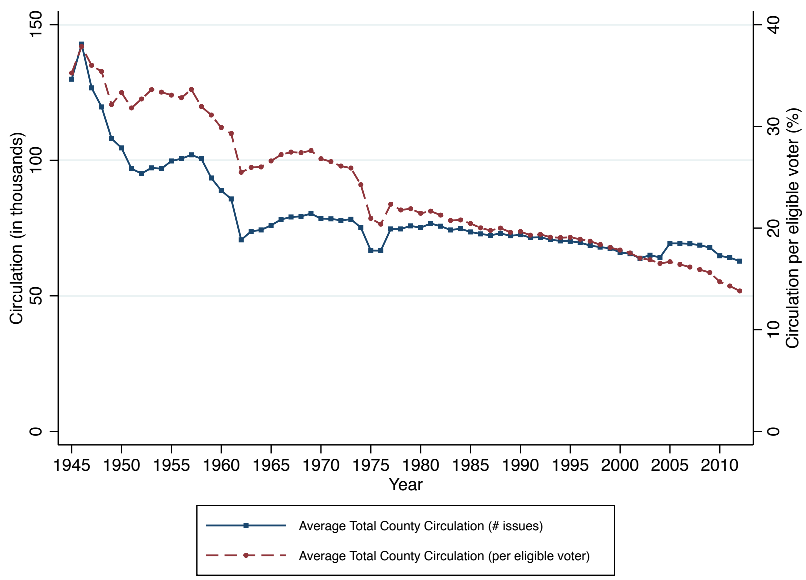
just below 30% in 2012 (right axis).

Finally, in Figure A.16, I plot the evolution of the average total county circulation.



Notes: The figure was constructed by the author using the circulation data described in details in this Appendix.

Figure A.15: *Circulation of a Local Newspaper in a County (Average)*



Notes: The figure was constructed by the author using the circulation data described in details in this Appendix.

Figure A.16: *Total County Circulation (Average)*

A.3 Additional Summary Statistics

Table A.2: *Descriptive Statistics on Incumbent Newspapers' Revenues, Expenses and Number of Employees the Year before an Entry*

	Entry
	mean/sd
Profit	-501
	(5,783)
Total Revenues	77,662
	(37,603)
Sales Revenues	43,552
	(23,267)
Ad Revenues	32,648
	(13,876)
Total Expenses	78,140
	(40,893)
Labor Expenses (Payroll)	33,019
	(17,713)
Intermediate Goods Expenses (Inputs)	41,956
	(23,684)
Number of Employees	508
	(271)

Notes: All variables (excepted the number of employees) are in (constant 2009) thousand euros. Time period is 1960-2012. The table presents the average and the standard deviations (between parentheses) of the variables.

Table A.3: *Low- vs. High- Heterogeneity Counties' Characteristics*

	(1)		
	High Heterogeneity	Low Heterogeneity	Diff/se
Education			
Elementary primary education (%)	0.57	0.59	-0.02***
			(0.01)
Secondary education (%)	0.33	0.32	0.01**
			(0.00)
Higher (post-secondary) education (%)	0.10	0.09	0.01***
			(0.00)
Socio-Economic Group			
Farmers (%)	0.09	0.13	-0.04***
			(0.00)
Artisans, shopkeepers and company managers (%)	0.09	0.08	0.01***
			(0.00)
Senior executives and knowledge workers (%)	0.07	0.06	0.01***
			(0.00)
Intermediate occupations (%)	0.17	0.16	0.01***
			(0.00)
Employees (%)	0.25	0.23	0.02***
			(0.00)
Laborers (%)	0.33	0.34	-0.01***
			(0.00)
Age			
Below 20 years old (%)	0.28	0.29	-0.01***
			(0.00)
Between 20 and 40 years old (%)	0.26	0.26	0.01***
			(0.00)
Between 40 and 60 years old (%)	0.24	0.24	0.00*
			(0.00)
Above 60 years old (%)	0.21	0.21	0.00
			(0.00)
Total Population (100,000)	5.04	5.27	-0.22
			(0.11)
Newspapers			
Number of Newspapers (1945-2012)	2.73	2.66	0.06
			(0.04)
Number of Newspapers (1960-2012)	2.50	2.49	0.01
			(0.04)
Observations	5866		

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares the characteristics of counties with high and low heterogeneity. Column 1 presents the results for counties with high heterogeneity. Column 2 presents the results for counties with low heterogeneity. In Column 3 I perform a t-test on the equality of means (standard errors in parenthesis).

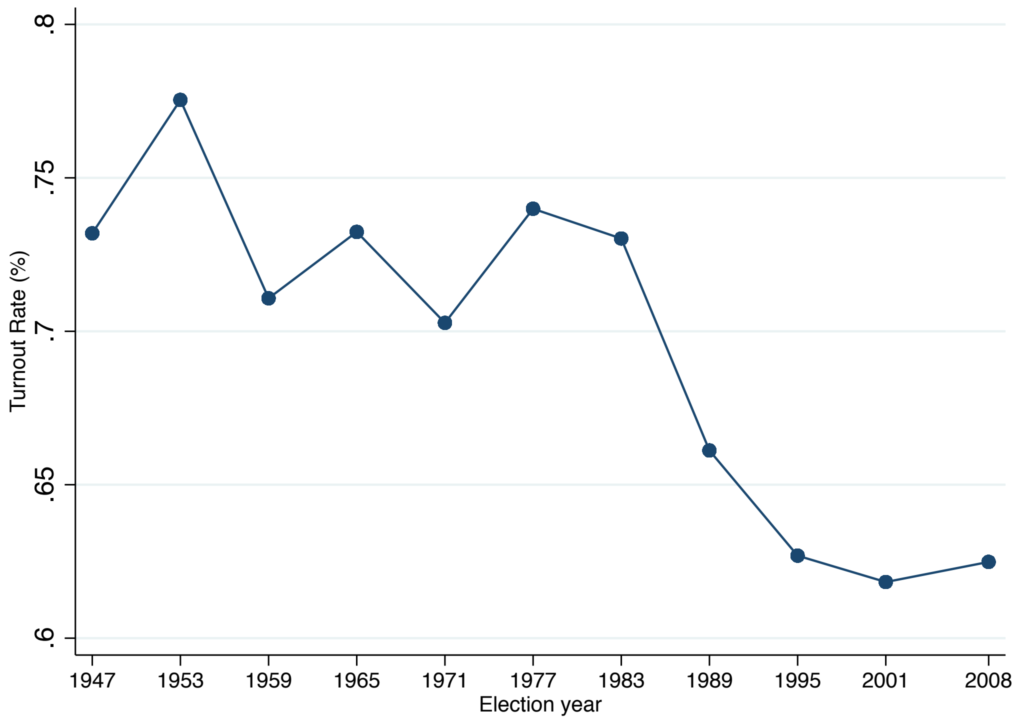


Figure A.17: *Turnout Rate at Local Elections (Average)*

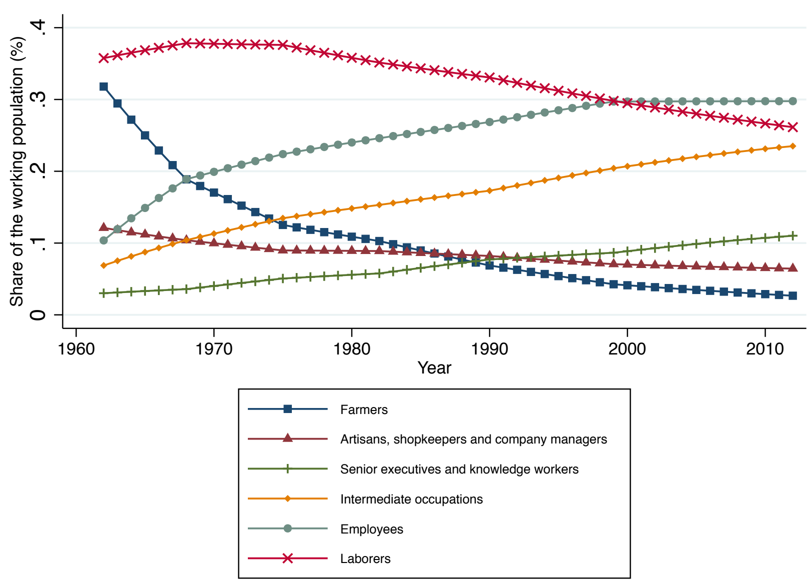


Figure A.18: *Socio-Economic Composition of France, 1962-2010*

Table A.4: *Summary Statistics of Newspapers' Readers (2006)*

	Average for France	**Local Daily Newspapers**	**Local Daily Newspapers**	**National Daily Newspapers**
	Outside Paris	Outside Paris		
Education				
Elementary primary education (%)	32.53	14.65	14.32	5.92
Secondary education (%)	47.21	59.34	59.21	45.90
Higher (post-secondary) education (%)	20.26	25.76	26.22	48.08
Socio-economic groups				
Farmers (%)	2.35	4.01	3.58	0.54
Artisans, shopkeepes and company managers (%)	6.26	6.21	6.21	4.92
Senior executives and knowledge workers (%)	11.57	11.37	11.46	27.82
Intermediate occupations (%)	23.19	22.78	23.03	26.52
Employees (%)	29.64	27.74	28.73	22.23
Laborers (%)	26.99	27.89	26.98	17.97
Age				
Above 60 years old (%)	30.91	38.04	36.72	27.15

Notes: The table gives summary statistics for newspaper readers' characteristics in 2006. Column 1 presents the distribution of education degrees, socio-economic groups and age in all French counties except the Paris area. Column 2 presents local daily newspaper readers' characteristics outside the Paris area, while column 3 presents these characteristics including the Paris area. Finally, column 4 presents these values for national daily newspapers' readers.

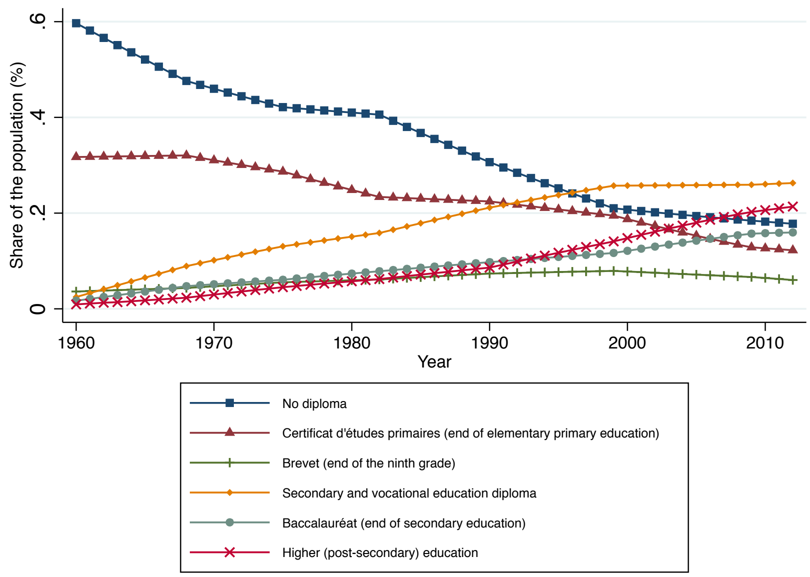


Figure A.19: *Educational Attainment in France, 1962-2010*

A.4 Additional Results

A.4.1 Newspapers' Entry Decision

In this section, I provide evidence that, on the one hand, the market size is a good predictor of the number of active newspapers, and that on the other hand, newspapers move in where there is a trending population.

My estimating equation is:

$$y_{ct} = \alpha + \beta_1 \text{ population}_{ct} + \beta_2 \text{ population growth}_{ct} + \beta_3 \text{ population density}_{ct} + \mu_t + \varepsilon_{ct} \tag{A.1}$$

where c indexes counties, t indexes years and μ_t is a year fixed effect. Table A.5 presents the results of the estimation. y_{ct}, the dependent variable, is alternatively the number of newspapers in county c and year t (columns 1 to 5); an indicator variable equal to one when a newspaper enters in county c and year t and to zero otherwise (columns 6 to 9); and an indicator variable equal to one when a newspaper *owner* enters in county c and year t and to zero otherwise (columns 10 to 13). The independent variables are population (above 20 years old), population growth, and population density. I control for population density because delivery costs may be lower in densely populated areas and thus the number of newspapers may be higher in these areas. As expected given existing empirical evidence (see e.g. Berry, 1992), I find that the number of newspapers in a county is strongly correlated with the county population (column 1). A one-standard deviation increase in population yields a 0.24 standard deviation increase in the number of newspapers. This positive correlation is robust to controlling for the number of newspapers present in the county in 1950 (at the end of the postwar adjustment period in the newspaper industry described below) even if its magnitude is halved (column 5).

Given the latent variable model – newspapers move in when there is a growing population – the entry decision should be correlated with population growth. It is indeed the case: whether I control or not for population, I find that population growth is positively and significantly correlated with the entry decision of newspapers (columns 6 and 9). Moreover, once I control for population growth, population per se has no statistically significant impact on the entry decision (column 9). This finding holds whether I consider all entries (columns 6 to 9) or I reduce the set of entries to episodes where not only a new newspaper but also a new newspaper *owner* enters a county (columns 10 to 13). The magnitude of the positive correlation between the entry decision and population growth is higher when I impose this restriction. Importantly, all my empirical results are robust to controlling or not for population and population growth.

Table A.5: *The Impact of Population on the Number of Newspapers and Newspapers' Entry Decision*

	Number of Newspapers					Entry Decision (Newpaper)				Entry Decision (Owner)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Population (in million)	1.17***				0.58***	0.04***			-0.01	0.05***			0.02
	(0.06)				(0.12)	(0.01)			(0.01)	(0.01)			(0.02)
Population Growth		-0.53			1.64		0.94**		0.60**		1.34***		0.89**
		(4.01)			(3.99)		(0.43)		(0.25)		(0.45)		(0.35)
Population Density (in thousand)			3.94***		0.50			0.13***	0.05			0.17***	0.09*
			(0.21)		(0.41)			(0.04)	(0.04)			(0.04)	(0.05)
Number of Newspapers in 1950				0.25***	0.22***								
				(0.01)	(0.01)								
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.21	0.16	0.21	0.30	0.31	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.06
Observations	4,611	4,524	4,611	4,611	4,524	4,611	4,524	4,611	4,524	4,611	4,524	4,611	4,524
Mean DepVar	2.50	2.48	2.50	2.50	2.48								

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are robust. Time period is 1960-2012. Models are estimated using OLS estimations. In columns 1 to 5, the dependent variable is the number of newspapers in a county. In columns 6 to 10, the dependent variable is an indicator variable equal to one when a new newspaper enters in a county and to zero otherwise. In columns 11 to 15, the dependent variable is an indicator variable equal to one when a new newspaper *owner* enters in a county and to zero otherwise. Variables are described in more details in the text.

A.4.2 Other Additional Results' Tables

Table A.6: *The Effect of Entry on Total County's Revenues, Expenses and Number of Employees (county-level analysis)*

		Revenues			Expenses					
	(1) Circulation	(2) Profit	(3) Total	(4) Sales	(5) Ad	(6) Total	(7) Inputs	(8) Payroll	(9) Employees	(10) Price
$\mathbf{1}entry^{j=-2}$	-0.01	-440.87	-536.46	-1,814.99	-480.82	-918.12	-492.99	-84.76	0.13	-0.04
	(0.01)	(786.58)	(3,872.41)	(2,025.39)	(1,277.36)	(3,274.13)	(1,558.78)	(1,768.46)	(35.11)	(0.04)
$\mathbf{1}entry^{j=-1}$	-0.00	-1,127.24	-76.38	-1,249.71	-102.89	398.00	419.95	585.63	0.14	-0.10***
	(0.01)	(926.22)	(4,726.06)	(2,631.78)	(1,767.10)	(4,360.34)	(1,725.68)	(2,719.32)	(46.05)	(0.04)
$\mathbf{1}entry^{j=0}$	0.03***	-1,272.71	-1,199.66	-3,378.72	-1,466.61	-386.66	-163.79	199.22	-14.01	-0.38***
	(0.01)	(1,026.32)	(5,254.30)	(3,363.41)	(2,156.07)	(4,730.03)	(1,980.78)	(2,845.61)	(50.10)	(0.05)
$\mathbf{1}entry^{j=1}$	0.03***	-1,644.42	-2,378.30	-3,592.24	-215.21	-1,038.27	-332.42	-194.49	-16.27	-0.36***
	(0.01)	(1,266.47)	(5,606.85)	(3,324.69)	(1,998.34)	(5,068.49)	(2,215.42)	(2,993.90)	(55.23)	(0.05)
$\mathbf{1}entry^{j=2}$	0.04***	-937.26	-1,025.20	-3,179.74	454.45	-1.54	308.99	51.57	-4.64	-0.37***
	(0.01)	(1,255.35)	(6,146.43)	(3,489.29)	(2,233.47)	(5,792.47)	(2,314.84)	(3,447.99)	(66.01)	(0.05)
$\mathbf{1}entry^{j=3}$	0.03**	-622.00	-3,759.33	-4,089.63	-497.44	-2,670.19	-779.54	-1,781.83	-32.67	-0.35***
	(0.01)	(646.02)	(6,535.56)	(4,036.36)	(2,463.12)	(5,774.80)	(2,997.52)	(3,146.94)	(66.61)	(0.06)
$\mathbf{1}entry^{j=4}$	0.05***	-1,383.39	-7,497.84	-4,183.77	-1,043.56	-6,919.52	-3,276.73	-3,900.71	-69.28	-0.39***
	(0.01)	(957.10)	(7,055.89)	(4,442.67)	(2,572.95)	(6,849.97)	(3,588.41)	(3,842.45)	(83.76)	(0.08)
$\mathbf{1}entry^{j\geq5}$	0.03**	-1,876.74*	-6,006.72	-1,599.87	-472.27	-3,889.22	-684.15	-2,505.22	-86.75	-0.35***
	(0.01)	(1,000.94)	(5,713.71)	(4,370.11)	(2,327.81)	(5,347.81)	(3,713.53)	(2,945.55)	(57.18)	(0.08)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.93	0.51	0.94	0.94	0.93	0.95	0.94	0.95	0.93	0.73
Observations	2,523	1,965	1,959	1,608	1,608	1,962	1,965	1,963	2,073	2,449
Clusters	87	78	78	78	78	78	78	78	87	87
Mean DepVar	0.18	467.23	29,151.63	17,045.63	11,737.73	28,742.31	15,032.59	12,311.62	216.31	0.80

Notes: Standard errors in parentheses are clustered by county. Time period is 1960-2012. Models are estimated using OLS estimations. All variables (excepted employees) are in thousand (constant 2009) euros. Price is in (constant 2009) euros. Models include year and county fixed effects and demographic controls. The demographic controls are the share of the population with higher (post-secondary) education and the share of working population between 15 and 64 year old which is senior executive or knowledge worker in county *c* and year *t*. Variables are described in more details in the text.

Table A.7: *The Effect of Entry on Newspapers' Revenues, Expenses and Number of Employees (newspaper-level analysis)*

			Revenues			Expenses			
	(1) Circulation	(2) Profit	(3) Total	(4) Sales	(5) Ad	(6) Total	(7) Inputs	(8) Payroll	(9) Employees
Pre Entry (t-3, t-2, t-1)	-0.00	-443.37	99.62	48.07	581.94	1,662.34	852.92	958.45	0.83
	(0.01)	(496.17)	(2,546.18)	(1,272.89)	(834.84)	(2,486.73)	(1,033.43)	(1,424.80)	(20.71)
Short-run Impact of Entry (t, t+1, t+2)	-0.01*	-709.76	-3,471.96	-2,534.33	-490.15	-1,655.27	-881.39	-522.47	-32.37
	(0.01)	(666.88)	(3,345.04)	(1,920.64)	(1,184.20)	(3,171.49)	(1,443.09)	(1,804.75)	(25.14)
Long-run Impact of Entry (t+3, onwards)	-0.03**	-821.88	-6,471.43*	-5,753.97**	-3,038.95**	-4,993.02	-2,352.11	-2,369.45	-70.43**
	(0.01)	(582.85)	(3,504.36)	(2,279.58)	(1,218.87)	(3,261.09)	(1,832.52)	(1,788.54)	(26.96)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
News FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.65	0.46	0.81	0.83	0.80	0.82	0.84	0.77	0.77
Observations	5,158	3,388	3,367	2,624	2,614	3,384	3,390	3,388	3,598
Clusters	87	78	78	78	78	78	78	78	87
Mean DepVar	0.09	270.99	16,961.10	10,445.64	7,220.46	16,664.42	8,713.58	7,133.33	124.63

Notes: Standard errors in parentheses are clustered by county. Time period is 1984-2009. Models are estimated using OLS estimations. All variables (excepted employees and price) are in thousand (constant 2009) euros. Price is in (constant 2009) euros. Models include year and county fixed effects and demographic controls. The demographic controls are the share of the population with higher (post-secondary) education and the share of working population between 15 and 64 year old which is senior executive or knowledge worker in county c and year t. Variables are described in more details in the text.

Table A.8: *The Effect of the Number of Newspapers on Newspapers' Content (Hard News)*

(a) ***Share of Articles on Hard News***

	Share of Articles on Information in the Newspaper					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of Newspapers	-3.55***	-2.77*	-3.68***	-3.09**	-2.10**	-3.77**
	(0.73)	(1.54)	(0.77)	(1.27)	(1.01)	(1.70)
Number of Newspapers * Low Heterogeneity		-2.96		-2.36		5.10*
		(1.96)		(1.90)		(2.73)
Low Heterogeneity		7.66*		6.23		-27.48
		(4.15)		(4.06)		(16.61)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.06	0.07	0.12	0.13	0.21	0.22
Observations	25,745	25,745	25,745	25,745	25,745	25,745
Clusters (County-Year)	88	88	88	88	88	88
Mean DepVar	33.73	33.73	33.73	33.73	33.73	33.73

(b) ***Number of Articles on Hard News***

	Number of Articles on Information per Issue					
Number of Newspapers	-64.6***	-79.3***	-61.0***	-80.0***	-68.7***	-92.8***
	(8.6)	(20.4)	(8.1)	(16.3)	(6.1)	(15.6)
Number of Newspapers * Low Heterogeneity		-6.4		6.3		30.7*
		(21.0)		(17.5)		(17.0)
Low Heterogeneity		56.8		24.6		-6.2
		(38.3)		(33.9)		(75.8)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.25	0.29	0.37	0.40	0.55	0.56
Observations	25,575	25,575	25,575	25,575	25,575	25,575
Clusters (County-Year)	92	92	92	92	92	92
Mean DepVar	103.1	103.1	103.1	103.1	103.1	103.1

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by county*year. Time period is 2005-2012. In the upper table (Table A.8a), the dependent variable is the share of articles on hard news which is defined as the number of articles on agriculture, economics, education, environnement, international or politics, divided by the total number of articles classified by topics. In the bottom table (Table A.8b), the dependent variable is the number of articles on hard news. The controls include demographic controls (the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in county *c* and year *t*) and the demographic controls interacted with the heterogeneity indicator variable. Variables are described in more details in the text.

Table A.9: *The Effect of the Number of Newspapers on Newspapers' Content (Soft News)*

	Number of Articles on Entertainment per Issue					
Number of Newspapers	-111.3***	-116.5***	-107.5***	-117.9***	-107.5***	-140.9***
	(14.6)	(30.6)	(13.8)	(27.0)	(13.8)	(23.8)
Number of Newspapers * Low Heterogeneity		-77.1**		-64.0**		-28.7
		(32.0)		(27.7)		(26.3)
Low Heterogeneity		264.2***		230.1***		284.6**
		(58.3)		(52.6)		(133.5)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.27	0.42	0.35	0.47	0.35	0.64
Observations	25,696	25,696	25,696	25,696	25,696	25,696
Clusters (County-Year)	92	92	92	92	92	92
Mean DepVar	197.3	197.3	197.3	197.3	197.3	197.3

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by county*year. Time period is 2005-2012. The bottom table (Table A.9) the dependent variable is the number of articles on soft news. The controls include demographic controls (the share of the population with higher (post-secondary) education, the share of the working population between 15 and 64 year old which is senior executive or knowledge worker and the total population in county *c* and year *t*) and the demographic controls interacted with the heterogeneity indicator variable. Variables are described in more details in the text.

Table A.10: *The Effect of the Number of Newspapers on Newspapers' Specialization*

	Newspaper Specialization					
	(1)	(2)	(3)	(4)	(5)	(6)
Number of newspapers	0.053***	0.071***	0.052***	0.078***	0.050***	0.058***
	(0.012)	(0.014)	(0.010)	(0.011)	(0.009)	(0.009)
Number of Newspapers						
* Low Political Heterogeneity		-0.054***		-0.063***		-0.047***
		(0.015)		(0.012)		(0.017)
Low Political Heterogeneity		0.073***		0.099***		0.245
		(0.027)		(0.024)		(0.169)
Year FE	No	No	Yes	Yes	Yes	Yes
Controls	No	No	No	No	Yes	Yes
R-sq	0.10	0.13	0.11	0.15	0.17	0.17
Observations	28,180	28,180	28,180	28,180	28,180	28,180
Clusters (County-Year)	94	94	94	94	94	94
Mean DepVar	0.173	0.173	0.173	0.173	0.173	0.173

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses are clustered by county-year. Time period is 2005-2012. The dependent variable is newspaper specialization computed alternatively on a daily basis. "Newspaper specialization" is an Herfindahl index of newspaper differentation. This index is equal to the sum of the squares of the shares of the different newpaper topics in each newspaper issue: agriculture, culture, economics, education, environnement, health, international, leisure activities, movies, "news in brief", politics religion and sports. The controls include demographic controls (the share of the population with higher (post-secondary) education, the share of working population between 15 and 64 year old which is senior executive or knowledge worker) and the total population in county *c* and year *t*), and demographic controls interacted with the heterogeneity dummy. Variables are described in more details in the text.

A.5 Proofs of the Theoretical Results

There is a continuum of consumers of mass 1 and two profit-maximizing newspapers under duopoly, newspaper 1 and newspaper 2 (only one newspaper under monopoly, newspaper m). I study the production choices (price and quality) of newspapers under monopoly and duopoly. The analysis is based on a two-stage non-cooperative sequential game. Newspapers first choose simultaneously their quality and then compete simultaneously in price.

A.5.1 Model Set-Up: Consumers

Consumers choose whether to buy a newspaper: $\alpha \in A = \{B, NB\}$ (B: buy; NB: do not buy). I assume that there is unit-demand: consumers cannot buy more than one unit of the newspaper. Moreover, in order to keep the model tractable, I assume that there is no multi-homing: when there are two newspapers, consumers can only buy one of the two. They cannot buy both newspapers at the same time.

Consumers differ in their willingness-to-pay for quality (vertical differentiation). Consumer i maximizes the following utility function:

$$V_i = \begin{cases} \gamma_i n_j - p_j, & \text{if she buys newspaper j} \\ 0, & \text{otherwise} \end{cases}$$

where p_j is the price of newspaper j, n_j is its quality and γ_i is consumer i's willingness-to-pay for quality. I assume that this taste is uniformly distributed with unit density over the interval $\left[\underline{\gamma}, \overline{\gamma}\right]$: $U \sim \left[\underline{\gamma}, \overline{\gamma}\right]$.

In the monopoly case, consumer i buys newspaper j iff

$$\gamma_i n_j - p_j \geq 0 \tag{A.2}$$

In the duopoly case, newspaper j's ($j = 1, 2$) demand, D_j, is defined as the set of consumer types who get greater surplus from its quality-price offering than from the other firm's quality-price offering or the outside option:

$$D_j = \left\{ \gamma \sim U \left[\underline{\gamma}, \overline{\gamma} \right] : \gamma n_j - p_j \geq \gamma n_z - p_z \ \forall z = 0, 1, 2 \right\} \tag{A.3}$$

Higher types (agents with a high γ) more strongly prefer higher-quality newspapers since they get an higher marginal benefit. They thus choose the higher-quality newspaper under duopoly. Middle types choose the lower-quality newspaper. Finally, if the market is not covered, lower types choose not to buy a newspaper. Importantly here I am not assuming market coverage ex ante. The extent of consumers' heterogeneity – measured by the ratio $\frac{\overline{\gamma}}{\underline{\gamma}}$ – determines whether the market is actually covered or not. Market coverage is an endogenous outcome of the quality game, as it will appear clearly below.

A.5.2 Model Set-Up: Newspapers

Newspapers maximize their profits by choosing their price p and their quality n:

$$\max_{(n_j, p_j)} \left[p_j D_j (\mathbf{n}, \mathbf{p}) - \frac{c n_j^2}{2} - S \right] \tag{A.4}$$

where S is the fixed cost for setting up a newspaper.[13]

The production cost is a quadratic function of the quality n and is given by $\frac{c n_j^2}{2}$. (The production cost increases with quality at a faster rate than any agent's willingness to pay for quality.)

I assume that the news market is one-sided, i.e. I do not take into account newspaper dependency on ad revenues. I recognize that newspapers derive revenue from both readers and advertisers. Implicitly, I am considering advertising revenue as a per-reader proportional subsidy.

A.5.3 Timing of the Game

The game proceeds as follows:

[13]This includes the annual costs that must be incurred in order to set up a newspaper (office space, equipment, printing press, etc.) and to maintain a reputation as a media outlet (e.g. one needs to have minimal number of journalists covering core issues, etc.).

1. Newspapers simultaneously choose their quality n.

2. Newspapers simultaneously choose their price p.

This time ordering is standard. What is important is that newspapers first compete simultaneously in quality before competing simultaneously in price. This allows newspapers to differentiate in quality in order to soften price competition. I solve this game by backward induction. I only consider pure-strategy equilibria.

A.5.4 Solving the Model

I compare the production choices of newspapers under monopoly and under duopoly. I do not consider the cases with more than two newspapers. That is, I assume that the set-up cost is sufficiently large ($s > \underline{S}$) so that a third entrant would suffer losses. Whether monopoly or duopoly prevails in equilibrium also depends on S. One can easily show that if S is sufficiently small ($\underline{S} < S < \overline{S}$), the second entrant can make positive profits, so that there is a duopoly. Conversely, for S sufficiently large ($S > \overline{S}$), no entry is profitable, so there is a monopoly.

A.5.4.1 Monopoly

Under monopoly, agent i buys the newspaper iff

$$\gamma_i \geqslant \frac{p_m}{n_m}$$

The marginal consumer type is thus $\widehat{\gamma}^M = \frac{p_m}{n_m}$ provided that $\widehat{\gamma}^M \in \left[\underline{\gamma}, \overline{\gamma}\right]$ (non-covered market case); otherwise the demand for the monopoly is 0 if $\widehat{\gamma} > \overline{\gamma}$ and 1 if $\widehat{\gamma} < \underline{\gamma}$ (covered marked case).[14]

Thee market configurations may arise at the price equilibrium. They are characterized by the following demand function.

[14] For the remainder of the proof and to save on space I will use the initials NCM for non-covered market and CM for covered market.

$$D_m(p_m, n_m) = \begin{cases} 0 & \text{if } \overline{\gamma} < \frac{p_m}{n_m} \\ 1 - \frac{\frac{p_m}{n_m} - \underline{\gamma}}{\overline{\gamma} - \underline{\gamma}} & \text{if } \underline{\gamma} < \frac{p_m}{n_m} \leq \overline{\gamma} \quad \text{(NCM)} \\ 1 & \text{if } \underline{\gamma} \geq \frac{p_m}{n_m} \quad \text{(CM)} \end{cases}$$

Figure A.20 shows how demand varies with the ratio $\frac{p_m}{n_m}$ for $\underline{\gamma} = 1$, i.e. $\frac{\overline{\gamma}}{\underline{\gamma}} = 2$. In Figure A.21 it appears clearly that the lower heterogeneity ($\frac{\overline{\gamma}}{\underline{\gamma}} = 2$ for the red continuous line, and 1.5 for the blue dashed line), the higher the demand for a given ratio $\frac{p_m}{n_m}$.

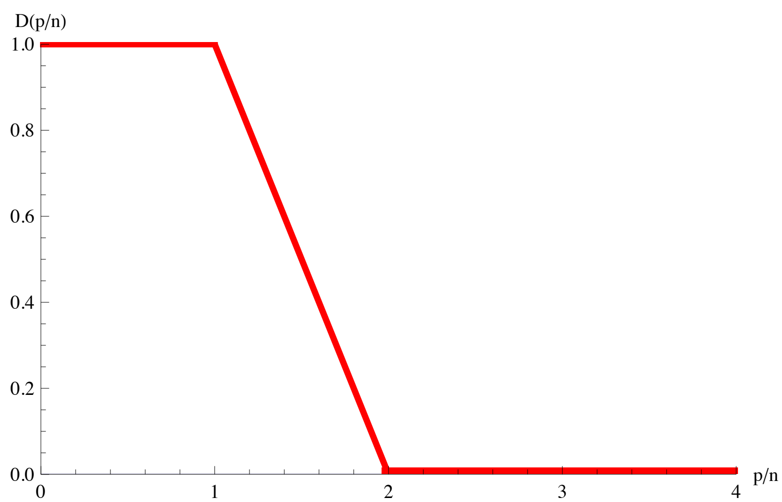


Figure A.20: *Demand Function of the Monopoly*

The monopoly maximizes its profits according to equation (A.4). The Nash equilibrium is the price subgame is:

$$p_m^* = \begin{cases} \frac{\overline{\gamma} n_m}{2} & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [2, \infty[\quad \text{(NCM)} \\ \underline{\gamma} n_m & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [1, 2[\quad \text{(CM)} \end{cases}$$

Computing the optimal quality n I obtain:

$$n_m^* = \begin{cases} \frac{\overline{\gamma}^2}{4c} & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [2, \infty[\quad \text{(NCM)} \\ \frac{\underline{\gamma}}{c} & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in [1, 2[\quad \text{(CM)} \end{cases}$$

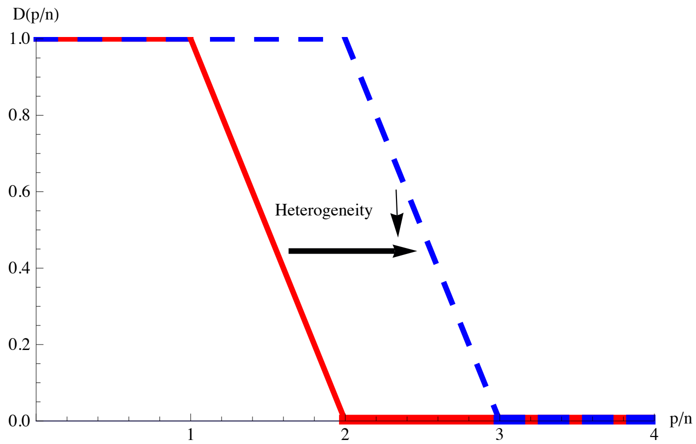


Figure A.21: *Demand Function of the Monopoly and Heterogeneity*

Proposition 11 (Monopoly Equilibrium) *Depending on the ratio $\frac{\overline{\gamma}}{\underline{\gamma}}$, the monopoly equilibrium is characterized by the following price p_m^*, quality n_m^*, demand D_m^* and profit Π_m^* :*

2

$$\text{If } \frac{\overline{\gamma}}{\underline{\gamma}} \in [1,2[\text{ then } \begin{cases} n_m^* = \frac{\underline{\gamma}}{c} \\ p_m^* = \frac{\underline{\gamma}^2}{c} \\ D_m^* = 1 \\ \Pi_m^* = \frac{\underline{\gamma}^2}{2c} \end{cases}$$

$$\text{If } \frac{\overline{\gamma}}{\underline{\gamma}} \in [2,\infty[\text{ then } \begin{cases} n_m^* = \frac{\overline{\gamma}^2}{4c} \\ p_m^* = \frac{\overline{\gamma}^3}{8c} \\ D_m^* = \frac{1+\underline{\gamma}}{2} \\ \Pi_m^* = \frac{\left(1+\underline{\gamma}\right)^4}{32c} \end{cases}$$

Figure A.22 represents the monopoly equilibrium a cost $c = 1$. It appears clearly that for the monopoly profits decrease with heterogeneity.

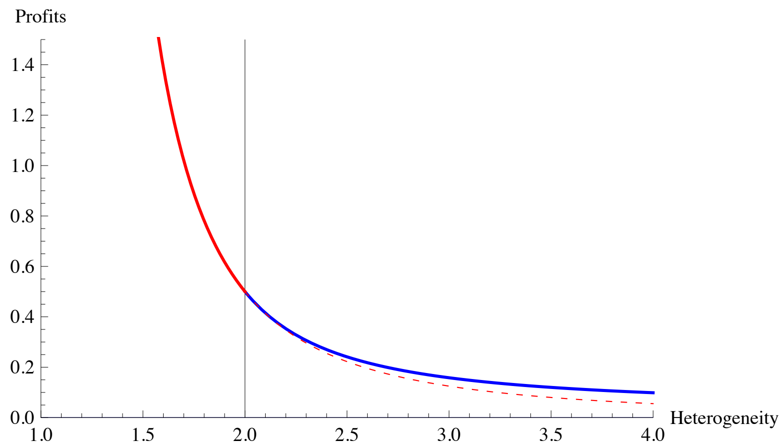


Figure A.22: *Monopoly: Profit*

A.5.4.2 Duopoly

The only Nash equilibrium is an asymmetric equilibrium in which one newspaper is of higher quality than the other newspaper. Newspapers always choose to differentiate because differentiation allows them to relax price competition while a symmetric equilibrium yields Bertrand competition. The key point is thus to determine whether the high-quality duopolist is of higher or of lower quality than the monopolist. It depends on the market coverage (the extent of business stealing). Here I do not assume market coverage ex ante and I determine the equilibrium for each market configuration. More precisely, for each market configuration, I first determine the Nash equilibrium in the price subgame taking as fixed n_2 and n_1. I then solve for the Nash equilibrium in the quality subgame.

Price Competition Without loss of generality, I assume that $n_2 > n_1$. The marginal consumer type is $\widehat{\gamma}^D = \frac{p_2 - p_1}{n_2 - n_1}$ provided that $\widehat{\gamma}^D \in \left[\underline{\gamma}, \overline{\gamma}\right]$.

Three market configurations may arise at the price equilibrium. Let consider the demand for newspaper 1. All consumers with a γ such that $\gamma < \widehat{\gamma}^D$ strictly prefer newspaper 1 to newspaper 2. However, they could refrain from buying. Only consumers with a γ such that $\gamma > \frac{p_1}{n_1}$ buy newspaper 1. Hence if $\frac{p_1}{n_1} < \underline{\gamma}$, all consumers with a γ such that $\gamma < \widehat{\gamma}^D$ buy newspaper 1, the market is covered and the demand for newspaper 1 is $\widehat{\gamma}^D - \underline{\gamma}$. On the contrary, if $\frac{p_1}{n_1} > \underline{\gamma}$ the market is not covered and the demand for newspaper 1 is $\widehat{\gamma}^D - \frac{p_1}{n_1}$ since all the consumers with a $\gamma \in \left[\underline{\gamma}, \frac{p_1}{n_1}\right]$ refrain from buying a newspaper. Finally, if $\frac{p_2}{n_2} < \underline{\gamma}$ then the market is preempted by newspaper 2.

The demand functions are as follows[15]:

$$(D_1, D_2) = \begin{cases} \left(\widehat{\gamma}^D - \frac{p_1}{n_1}, \overline{\gamma} - \widehat{\gamma}^D\right) & \text{if } \underline{\gamma} < \frac{p_1}{n_1} \leq \widehat{\gamma}^D \quad \text{(NCM)} \\ \left(\widehat{\gamma}^D - \underline{\gamma}, \overline{\gamma} - \widehat{\gamma}^D\right) & \text{if } \frac{p_1}{n_1} \leq \underline{\gamma} \leq \frac{p_2}{n_2} \quad \text{(CM)} \\ (0,1) & \text{if } \frac{p_2}{n_2} < \underline{\gamma} \quad \text{(Preempted)} \end{cases}$$

The intuition for the preempted market case is as follows: since $n_2 > n_1$ all agents prefer newspaper 2 to newspaper 1 when $p_1 = p_2$. Newspaper 2 thus benefits from the possibility of preempting the market with a limit price: $p_2 = p_1 + \underline{\gamma}(n_2 - n_1)$. It is easy to show that the market is preemted by newspaper 2 whenever $\frac{\overline{\gamma}}{\underline{\gamma}} \in]1, 2]$. In this case if $n_2 > n_1$ only one newspaper (newspaper 2) is active in the price game.

Nash equilibrium in the price subgame is obtained in two steps. First I compute equilibrium candidates corresponding to each market configuration. Second I identify the parameters constellations for which candidates effectively yield the corresponding market outcome. I identify intervals for the values of $\frac{\overline{\gamma}}{\underline{\gamma}}$ whose bounds depend on (n_1, n_2).

Let first consider price equilibrium. The price equilibrium for the non-covered market case is simply determined by maximizing the profits with respect to the price. For the covered-market case, there are two possible solutions: a corner and an interior solution.

Price equilibrium are as follows:

[15] To simplify the notations I am simply using D_1 for $D_1(p_1, p_2, n_1, n_2)$ and D_2 for $D_2(p_1, p_2, n_1, n_2)$.

$$(p_1^*, p_2^*) = \begin{cases} \left(\frac{n_1(n_2-n_1)\overline{\gamma}}{4n_2-n_1}, \frac{2n_2(n_2-n_1)\overline{\gamma}}{4n_2-n_1}\right) & \text{if } \underline{\gamma} < \frac{p_1}{n_1} \leq \widehat{\gamma}^D \quad \text{(NCM)} \\ \left(\underline{\gamma} n_1, \frac{(n_2-n_1)\overline{\gamma}+\underline{\gamma} n_1}{2}\right) & \text{if } \frac{p_1}{n_1} \leq \underline{\gamma} \leq \frac{p_2}{n_2} \quad \text{(CM corner)} \\ \left(\frac{\overline{\gamma}-2\underline{\gamma}}{3}(n_2-n_1), \frac{2\overline{\gamma}-\underline{\gamma}}{3}(n_2-n_1)\right) & \text{if } \frac{p_1}{n_1} \leq \underline{\gamma} \leq \frac{p_2}{n_2} \quad \text{(CM interior)} \end{cases}$$

Given these price equilibrium, it is easy to show that the market is non-covered (NCM) if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{4n_2-n_1}{n_2-n_1}, \infty\right[$; that the market is covered with a corner solution (CM corner) if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{2n_2+n_1}{n_2-n_1}, \frac{4n_2-n_1}{n_2-n_1}\right[$; and that the market is covered with an interior solution (CM interior) if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left]2, \frac{2n_2+n_1}{n_2-n_1}\right[$.

The Nash equilibrium in prices is thus a function of the degree of population heterogeneity ($\frac{\overline{\gamma}}{\underline{\gamma}}$) and the degree of product differentiation (n_1,n_2). This appears clearly when rearranging the conditions. The market is non covered if $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{4n_2-n_1}{n_2-n_1}, \infty\right[\Leftrightarrow n_1 < n_2\frac{\alpha-4}{\alpha-2}$. The market is covered with a corner solution if $\frac{2n_2+n_1}{n_2-n_1} \leq \frac{\overline{\gamma}}{\underline{\gamma}} \Leftrightarrow n_1 < n_2\frac{\alpha-2}{\alpha+1}$.

In Figures A.23 and A.24 I plot the prices as a function of heterogeneity for different degrees of product differentiation (n_1,n_2). The price of newspaper 1 p_1 is given by the continuous line and the price of newspaper 2 p_2 by the dashed line. It appears clearly that the more product differentiation, the higher the price newspapers charge.

Quality subgame Newspapers choose their quality in order to maximise their profits:

$$\max_{n_j} \Pi_j = p_j^* D_j\left(p_j^*, p_{j'}^*, n_j, n_{j'}\right) - \frac{cn_j^2}{2}, \; j = 1, 2$$

Assuming ($n_2 > n_1$), I first determine the local maximum for each of the three market configurations – the three price equilibrium. (To simplify the notations I note here Π_j the net profit – after deduction of the set-up cost S).

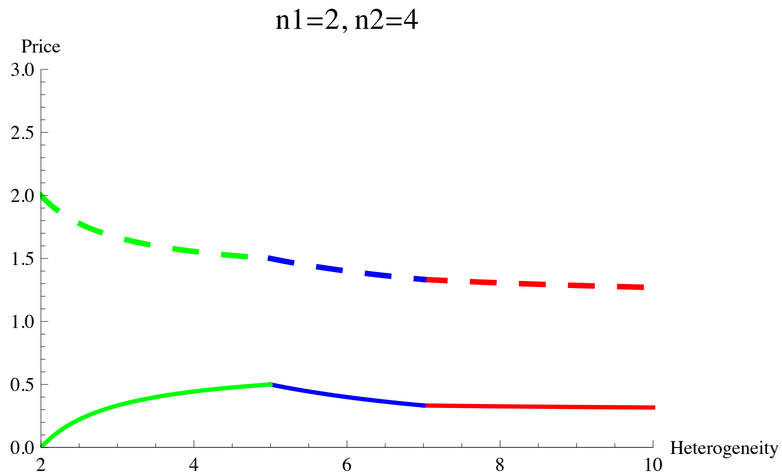


Figure A.23: *Duopoly: Nash Equilibrium in Prices*

$$(\Pi_1, \Pi_2) = \begin{cases} \left(\frac{n_1 n_2 \overline{\gamma}^2 (n_2-n_1)}{(4n_2-n_1)^2} - c\frac{n_1^2}{2}, \frac{4n_2^2 \overline{\gamma}^2 (n_2-n_1)}{(4n_2-n_1)^2} - c\frac{n_1^2}{2} \right) & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{4n_2-n_1}{n_2-n_1}, \infty \right[\\ \left(\frac{\underline{\gamma} n_1}{2(n_2-n_1)} \left[(n_2-n_1) \left(\overline{\gamma} - 2\underline{\gamma} \right) - \underline{\gamma} n_1 \right] - c\frac{n_1^2}{2}, \frac{\left[\underline{\gamma} n_1 + \overline{\gamma}(n_2-n1) \right]^2}{4(n_2-n_1)} - c\frac{n_1^2}{2} \right) & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{2n_2+n_1}{n_2-n_1}, \frac{4n_2-n_1}{n_2-n_1} \right[\\ \left(\frac{(n_2-n1)\left(\overline{\gamma}-2\underline{\gamma}\right)^2}{9} - c\frac{n_1^2}{2}, \frac{(n_2-n1)\left(2\overline{\gamma}-\underline{\gamma}\right)^2}{9} - c\frac{n_2^2}{2} \right) & \text{if } \frac{\overline{\gamma}}{\underline{\gamma}} \in \left] 2, \frac{2n_2+n_1}{n_2-n_1} \right[\end{cases}$$

Let first consider the **non-covered market case** which corresponds to the parameters constellation $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left[\frac{4n_2-n_1}{n_2-n_1}, \infty \right[$. Solving for the first order condition of the two newspapers and combining them together I obtain:

$$4n_2^3 - 8n_1^3 - 23n_1 n_2^2 + 12n_1^2 n_2 = 0 \tag{A.5}$$

Setting $n_2 = \mu n_1$ and dividing both sides by n_1^3 I rewrite equation (A.5) as follows:

$$4\mu^3 - 23\mu^2 + 12\mu - 8 = 0 \tag{A.6}$$

Equation (A.6) has only one real soluton: $\mu = 5.25123$. Hence the non-covered market

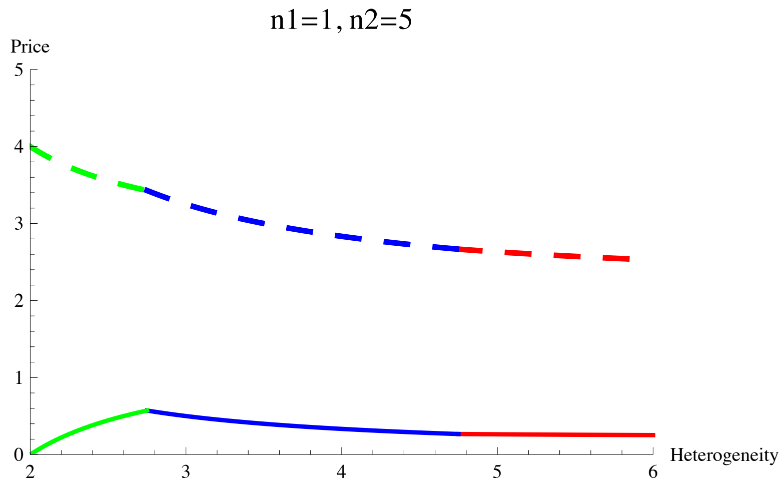


Figure A.24: *Duopoly: Nash Equilibrium in Prices*

solution is:

$$\text{If} \quad \frac{\overline{\gamma}}{\underline{\gamma}} > 4.7 \quad \begin{cases} n_1^* = 0.0482\frac{\gamma^2}{c} \\ \\ n_2^* = 0.2533\frac{\gamma^2}{c} \end{cases}$$

Second, I study the **covered-market case with an interior solution** ($\frac{\overline{\gamma}}{\underline{\gamma}} \in \left]2, \frac{2n_2+n_1}{n_2-n_1}\right[$). In this case newspaper 1's profits are given by:

$$\Pi_1 = \frac{\left(1-\underline{\gamma}\right)^2}{9}(n_2 - n_1) - c\frac{n_1^2}{2}$$

These profits are strictly decreasing in n_1 so newspaper 1 will produce the lowest possible amount of n_1.

Rearranging condition $\frac{\overline{\gamma}}{\underline{\gamma}} \in \left]2, \frac{2n_2-n_1}{n_2-n_1}\right[$ I obtain that the market is covered with an interior solution whenever $n_1 > n_2\frac{1-\gamma}{1+3\underline{\gamma}}$. Newpaper 1 thus chooses $n_1 = n_2\frac{1-\gamma}{1+3\underline{\gamma}}$. Combining this value with the first order condition for newspaper 2 the interior solution covered market equilibria is:

$$\text{If} \quad \frac{\overline{\gamma}}{\underline{\gamma}} \in]2, \infty[\quad \begin{cases} n_1^{***} = \frac{1}{3c} \frac{\underline{\gamma}(1-\underline{\gamma})(2+3\underline{\gamma})^2}{\left(1+2\underline{\gamma}\right)^2} \\ \\ n_2^{***} = \frac{1}{3c} \frac{\underline{\gamma}\left(2+3\underline{\gamma}\right)^2}{\left(1+2\underline{\gamma}\right)^2} \end{cases}$$

When $\left(\overline{\gamma}, \underline{\gamma}\right)$ take values such that a reply is defined for two configurations, I compare corresponding profits in order to identify the best reply.

Finally I check that the local maximum I obtain are Nash equilibrium. In other words, I check that (i) newspaper 1 has no incentive to “leapfrog" newspaper 2 and itself produce the highest quantity; and that (ii) newspaper 2 has no incentive to deviate and produce a quantity of news lower than that produced by newspaper 1. Comparing the production choices of newspapers under monopoly and duopoly I obtain the following proposition:

Proposition 12 (Business stealing and returns to scale in news production)
Assume n_m^* is the monopoly equilibrium and (n_1^*,n_2^*) is the duopoly equilibrium. $\exists\ \underline{\lambda}, \overline{\lambda}$ such that
If $\frac{\overline{\gamma}}{\underline{\gamma}} \geq \overline{\lambda}$ (high heterogeneity of tastes), $n_1^* < n_m^* < n_2^*$ (i.e. under duopoly, one duopolist produces a lower-quality newspaper than the monopolist, and the other one a higher-quality newspaper).
If $\frac{\overline{\gamma}}{\underline{\gamma}} < \underline{\lambda}$ (low heterogeneity of tastes), $n_1^* < n_2^* < n_m^*$ (i.e. under duopoly, both duopolists produce a lower-quality newspaper than the monopolist).

A.6 Voting Model

The voting model I present in this section is closely related Feddersen and Pesendorfer (1996) and Feddersen and Sandroni (2006a,b). Society must choose between two candidates by majority voting. There are two states of nature: one in which all voters prefer the first candidate and a second state where all prefer the other candidate. Voters have state dependent preferences: there are no partisans. I voluntarily chose to abstract from political bias considerations. In the benchmark case of my model as well as in the general case with vertical differentiation, readers do not have political opinions and individuals are only heterogenous in their preferences for information and entertainment; there is no media bias and newspapers are pure profit-maximizers. Agents are motivated to vote out of a sense of ethical obligation. Each agent has an action she should take and receives utility from taking this action. Hence each agent behaves strategically even though pivotal probabilities play no role.

I assume that people learn information for their voting decision as a by-product of newspaper readership. An important number of studies have shown that people often learn politically relevant facts as a by-product of nonpolitical routines (Prior, 2007). Taking the example of moviegoers sitting through a newsreel even though they came to be entertained by the main feature, Downs (1957, p. 223) underline that political information is sometimes obtained from entertainment-seeking behavior: "entertainment sources sometimes yield political information as a surplus benefit from what is intended as an entertainment investment". Focusing on television, Baum (2002, 2003) argues that a mix of entertainment and politics provides political information to people not sufficiently interested in politics to watch hard news.[16] Similarly, Zukin and Snyder (1984) show that many politically uninterested New Jersey citizens who received their broadcast news from New York City stations

[16] According to Baum (2002, 2003, 2005), viewers select programs based on the desire to be entertained, but still learn about politics because the programs they pick also contain information. He shows for example that some people who would otherwise not watch any news at all pay attention to coverage of wars and foreign policy crises in soft-news programs (Baum, 2002). He finds in the same way that when presidential candidates appear on entertainment talk shows, they sway a segment of the population that would otherwise not heard much about the campaign (Baum, 2005).

recaled the names of New York mayoral candidates, even though they could not vote for any of the candidates. In this paper, I assume along the same lines that even readers buying a newspaper mainly for the entertainment pages it contains acquire information relevant in the political process from the information pages of the newspaper. This information affects whether or not they would go to the polls.

A.6.1 Model Set-Up: Nature

There are two equally likely states of Nature $\Theta \in \{0, 1\}$ that are unobservable. There is a continuum of agents of mass 1 who share a common prior about the state of Nature (one half). There are two candidates running for the election, candidate 0 and candidate 1: $\Omega = \{0, 1\}$. The candidate that receives the majority of the votes cast is elected (if there is a tie, each candidate is chosen with equal probability). One can think of the two candidates as being the "status quo" and the "alternative", and assume that there is some uncertainty about the cost of implementing the alternative which can be either high or low.

A.6.2 Model Set-Up: Consumers

Consumers – which are also the potential newspaper buyers described in the previous section – take two actions. First they choose whether to buy a newspaper, according to the utility function described in more details above, and next they choose whether to vote: $s \in S = \{a, 0, 1\}$, where a denotes abstention, 0 denotes vote for candidate 0 and 1 vote for candidate 1. There is no partisan. Voters have state dependent preferences, i.e. given a pair (ω, θ), $\omega \in \Omega$ and $\theta \in \Theta$, the utility of a potential voter is:

$$U(\omega, \theta) = \begin{cases} 0, & \text{if } \omega \neq \theta \\ U > 0, & \text{if } \omega = \theta \end{cases}$$

Every voter receives a message $m \in M = \{0, 1, \phi\}$. Voters who receive a message 0 or 1 are informed and all others are uninformed. As underlined above, I assume that the information acquisition is exogenous in the voting stage of the game: voters who buy a newspaper are informed and all others are uninformed.[17] I call $q \in (0,1)$ the fraction of informed voters in the population. Among the informed voters, the fraction which observes the message $m \in \{0,1\}$ in state m is $\rho \in (.5,1]$. When ρ is close to 0.5 the message is a very noisy signal of the true state, while when ρ is close to 1 the message almost perfectly conveys the true state.

I assume that ρ is an increasing function of n (the quality of the newspaper) s.t. $\rho(0) = 0.5$ and $\rho'(n) > 0$. In other words, the higher the quality of the newspaper, the better the quality of the signal received by the reader. Finally, there is a uniformly distributed cost of voting $C \sim U\left(0, \overline{C}\right)$.

A.6.3 Timing of the Game

The game proceeds as follows:

1. Nature draws $\theta \in \Theta = \{0,1\}$.
2. Newspapers choose their quality n and price p.
3. Voters choose $\alpha \in A = \{B, NB\}$ (whether to buy a newspaper, and which one).
4. Voters choose $s \in \{a, 0, 1\}$ (voting decision).
5. The state of nature is revealed.

I solve the game by backward induction.

A.6.4 Solving the Model

Proposition 13 shows how information provided by newspapers affects voting behavior.

Proposition 13 (Less information leads to rational abstention)

(i) Only informed voters (reading a newspaper) vote.

[17] A possible extension will be to endogenize the acquisition of information. However it will make the model much less tractable without modifying its main predictions.

(ii) Among informed voters, if there are different degrees of information (two newspapers with different n competing on the market), then only the informed voters reading the higher-quality newspaper vote.
(iii) There is a cut-off point such that better informed voters with voting costs above this threshold should abstain. This cut-off point is increasing in the quality of the newspaper n.

This is consistent with existing empirical evidence showing that individuals with high level of information are much more likely to vote than those with low levels (Converse, 2006; Parlfrey and Poole, 1987).

Combining Propositions 1 and 13, I obtain the following predictions on how the media environment affects political behavior.

Prediction 1 (High heterogeneity)

If heterogeneity in consumers' willingness-to-pay for quality is high, then
(i) Turnout is higher under duopoly than under monopoly.
(ii) Voters are better informed under duopoly than under monopoly.

Prediction 2 (Low heterogeneity)

If heterogeneity in consumers' willingness-to-pay for quality is low, then
(i) Turnout is lower under duopoly than under monopoly.
(ii) Voters are less informed under duopoly than under monopoly.

Appendix B

Appendix to Chapter 2

B.1 Data

B.1.1 Data on Mission Centers Location and Investments

The *Geography Atlas of Protestant missions*, published in 1903, was the result of an extensive work of localizing all the missionary stations around the world and reporting all the activities they were investing in. Of all the reports, conducted in 1896, 1903, 1911 and 1925, this one (1903) is the most precise and extensive version as investments, denomination, number of students, teachers (both native and foreign) and missionaries are reported for each mission localized on the maps.

The Atlas contains maps of all the regions in the world and locates all the missions active in 1903. Figure B.2 provides an example of these maps. All the missions are uniquely identified in a statistical index providing detailed information on the type of infrastructure available and the number of workers and students. Figure B.1 shows a section of this statistical index.

List of variables available for each mission station

- **Latitude:** Latitude of the mission settlement. This variable was constructed from our geocoding work and is only available for sub-Saharan Africa

- **Longitude:** Longitude of the mission settlement. This variable was constructed from our geocoding work and is only available for sub-Saharan Africa
- **Society:** Society to which the mission is affiliated
- **Denomination** Denomination of the society, if relevant
- **Id:** Unique identifier per mission
- **Name:** Name of the mission's location as reported in the Atlas
- **Printing:** Number of printing presses in the mission
- **Date:** Date of arrival of the mission
- **Anti foot-binding society:** Binary variable equal to one if mission belonged to an anti-foot-binding society
- **Church building:** Number of Churches in the settlement.
- **Blind School:** Binary variable equal to one if mission had a school for the blind or conducted special work for the blind
- **Deafmute school:** Binary varuable equal to one if mission had a school for the deaf-mute or conducted special work for the deaf-mute.
- **Female helper:** Number of female helper workers
- **Insane Asylum:** Binary variable equal to one if mission had an insane asylum
- **High School:** Binary variable equal to one if mission had a high school infrastructure.
- **Male Foreign Missionary:** Number of male foreign missionaries working in the mission.
- **Literary Worker:** Number of literary workers.
- **Orphanage:** Binary variable equal to one if mission had an orphanage

- **Sunday-School:** Binary variable equal to one if mission had a Sunday-school
- **Rendez-Vous for training new missionaries:** Binary variable equal to one if mission had a center for training new missionaries
- **Temperance Society:** Binary variable equal to one if mission belonged to a temperance society
- **Number of Students:** Number of students in the mission
- **Foundling asylum or nursery mission:** Binary variable equal to one if mission had a foundling asylum
- **Refuge for opium victims** Binary variable equal to one if mission had a refuge for opium victims
- **Theological school** Number of theological schools in the mission
- **Native male teachers** Number of native male teachers in the mission
- **Medical or nurses' class or school** Binary variable equal to one if mission thaught medical or nurse's class
- **Bible society:** Binary variable equal to one if mission was a Bible society
- **Dispensary:** Number of dispensaries in the mission
- **Leper asylum:** Binary variable equal to one if mission had a leper asylun
- **Woman who is unmarried or a widow:** Number of unmarried or widow women in the mission (probably from the country of origin of the mission).
- **Society of young people:** Binary variable equal to one if mission belonged to a society of young people
- **Day School:** Number of elementary school infrastructure
- **College or university:** Number of college or university infrastructure

- **Wife of a missionary:** Total number of women who were the wife of a missionary
- **Hospital** Binary variable equal to one if mission had a hospital
- **Kindergarden** Number of kindergarden infrastructure
- **Anti-opium society** Binary variable equal to one if mission belonged to an anti-opium society

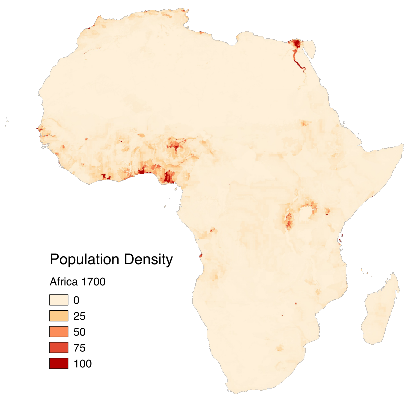
A

Abaco, see **Great Abaco Island**
Abadiyeh, 12-Palestine Inset. — **FFMA** (1899) m w 3-N 2-n 3-x=c s 2-v D
Abasa, ? Gold Coast, Plate 14. — **WMS** m 64-Nn 64-O 584-x=10-c 7-s 6-v
Abbotabad, 11-D1. — **CEZMS** (1894) 3-W n=160 zenana pupils
CMS (1899) 2-m w (p) (l) N 9-x=D
Abebify, 14-D7. — **B** (1876) 2-m 2-w 20-N n 17-O 731-x=s 15-v K (Abetifi)
Abeih, very near **Baakleen,** 12-Palestine Inset. — See **Mt. Lebanon,** work of **PN**
Abeokuta, 14-E7. — **CMS** (1846) 2-m w 2-W 24-N 5-n 1122-x=c 17-v T D L
SBC (1856) m w 2-N n 2-O 26-x=c s v
WMS 2-m 30-Nn 22-O 264-x=7-c 7-s 3-v
Aberdeen, 13-C1. — **BFSS** (1874) 2-m
Abetifi, see **Abebify**
Abo, see **Aboa**
Aboa, 14-F8 Inset. — **MGB** (1900) m=c v (Abo)
Abokobi, see **Agbogba**
Abors, corner of Tibet, China and Assam, north of **Dibrugarh,** 10-H1. — **MPA** (1900) 2-m (l)=D
Aburah, 14-D7. — **WMS** m 49-Nn 75-O 545-x=10-c 10-s 5-v
Aburi, 14-D7. — **B** (1847) 3-m 2-w W 14-N 4-n 9-O 716-x=10-v K
WMS 3-m W 93-Nn 18-O 644-x=15-c 13-s 14-v h
Acca, see **Acre**
Accra, or **Akra,** 14-D7. — **NBC** (1900) m 50-x=c s
WMS 3-m 34-Nn 30-O 582-x=4-c 7-s 2-v
Achampatti, 12-E6. — **CMS** N
Achena, ? Ind. Ter., 3 and Inset. — **PNH** (1887) N 26-x=c s
Acre, Akka, or **Accho,** 12-Palestine Inset, 13-L7. — **CMS** (1890) 2-m 2-w 4-W (p)=D H (Acca)
Acton Homes, 18-E5. — **WMSA** 29-N 12-O 297-x=2-c 3-s 2-v
Aleppo, 12-K9, 13-M6. — **PCEJ** (1895) 2-m (p) 3-N n= s B v D
Alert Bay, 2-I6. — **CMS** (1878) 2-m 2-w 2-W N n 22-x h I
Alessandria, 13-EF4. — **MEN** N O 61-x=s
Alexandria, 12-I10, 13-Ks, 15-G1. — **AJM** No statistic
BFBS 2-m 3-N=B
CSJ 4-m 3-w 3-W=4-v
DAK (1857) 13-W=H
EMB (1898) 7-m
IU (1898) m w=home of rest
LSPCJ No statistics
NAM (1892) 2-m 2-w 2-W N n=c v
UP (1857) 2-m w 2-W=B
WMS m 2-N 45-x=s
Algeciras, 13-B6, 7. — **SSM** (1890) m w N n=c v
Algiers, 13-D6, 14-E1. — **BFBS** (1882) m w 6-Nn=B
FSEJ m
NAM (1892) 2-m 2-w 2-W (l)=2-s
PB m w W
PCFI No statistics
SMF (1887) m w=c s
TM (1888) 5-W
Aligarh, 11-FG5. — **CMS** (1863) m w 3-W 21-N 10-n 3 82-x=c 10-v
MEN 4-m 2-w W 14-N 16-n 720-x=2-c 32-s S 15-v I
Aliwal North, 17-G7, 18-B7. — **PMMS** (1870) 2-m 2-w 5 9-O 1188-x=c s 2-v 2-T I t
Allahabad, 10-A2. — **BFBS** m=B
CMS (1859) 9-m 6-w 12-N n 300-x=c 5-v T
MEN 2-m w 9-N 9-n 67-x=c 27-s S 13-v f o
PN (1836) 4-m 2-w 5-W (p) 18-N 8-n 2-O 150-x=3-c 2 6-v 3-h D H
WU (1868) 2-W N 31-n=6-s B 14-v Rescue work, a special services for beggars
YMCA (1900) m=Y
ZBM 6-W N 19-n=5-v h o 260 zenana pupils
Allepie, see **Alleppey**

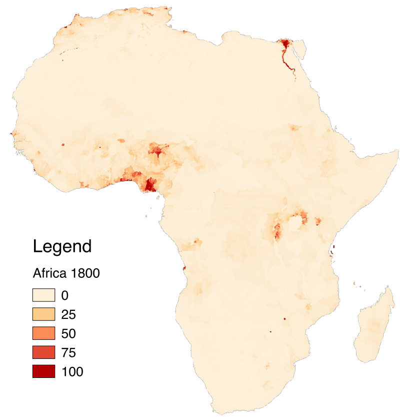
Figure B.1: *Part of the Statistical index from the Geography Atlas of Protestant missions*

Figure B.2: *Plate Representing all the Missionary Stations in 1903, West Africa*

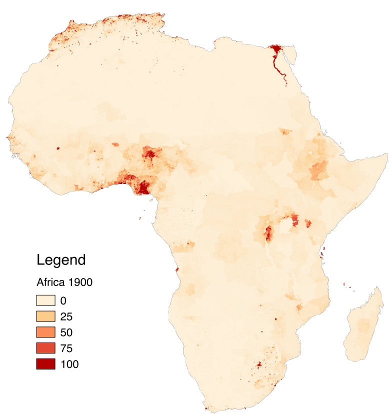
B.1.2 Population Data



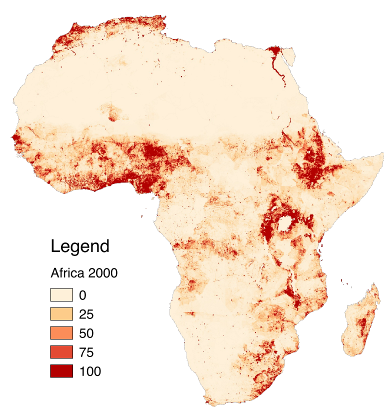
(a) *1700*



(b) *1800*



(c) *1900*



(d) *2000*

Notes: Population density in 1700 and 1800 varies between 0 and 20 in most of the sub-Saharan territory. Hence the low level of variation observed in the images.

Figure B.3: *Population Density from HYDE 3.1*

B.1.3 Light Data

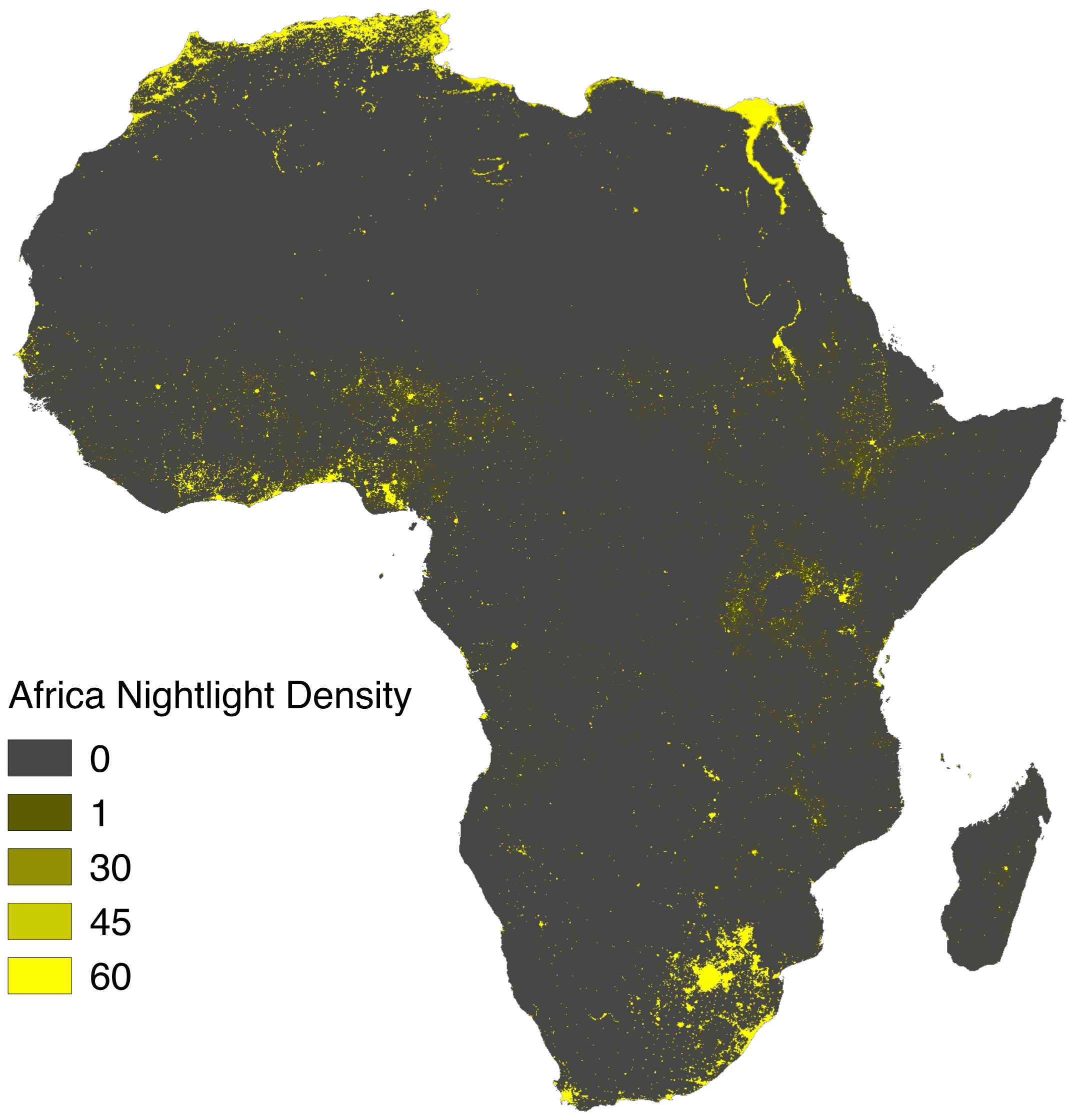


Figure B.4: *Light Density at Night in Africa*

B.1.4 Afrobarometer Data

We use data from the 2005 Afrobarometer survey, which is a comparative series of national surveys on attitudes towards democracy, markets, and civil society in Africa. Surveys contain representative information at the individual level of attitudes towards political and social outcomes as well as individual evaluations of living standards. Table B.1 gives a brief description of all the variables from the Afrobarometer used in our analysis.

A precise description of the survey, variables and sampling methods is available on the Afrobarometer website, `http://www.afrobarometer.org`. Similarly, all the questionnaires used for the construction of the dataset are available on the `http://www.afrobarometer.org/survey-and-methods/questionairres` website.

B.1.5 Controls

Historical Characteristics

- **Cities 1400**: indicator variable that equals one if there was a city located on the land inhabited by each ethnic group. **Source**: Nunn and Wantchekon (2011) using data from Chandler (1987) on the location of African cities with more than 20,000 inhabitants in year 1400.

- **Distance to 1400 City**: the distance is computed by the authors using ArcGIS. **Source:** The information on the location of cities in 1400 is from Nunn and Wantchekon (2011).

- **Distance to 1800 City**: the distance is computed by the authors using ArcGIS. **Source:** The information on the location of cities in 1800 is from Nunn and Wantchekon (2011).

- **Distance to Catholic mission in 1889:** the distance is computed by the authors using ArcGIs. **Source:** The information on the location of missions in 1889 is from Nunn (2009a). He geocoded the original map from Béthune (1889).

- **Explorer contact**: indicator variable that equals one if a European explorer traveled through land historically occupied by the ethnic group (the variable captures exploration routes between 1768 and 1894). **Source**: Nunn and Wantchekon (2011) using information on the location of railway lines in the first decade of the twentieth century from Company (1911).

- **Initial population density**: The average population density estimate in the 18th Century in a buffer of 10 km around each location. From the HYDE 3.1 database.

- **Malaria ecology of the land**: Malaria stability index. The index takes into account the prevalence and type of mosquitoes endemic to a region, their human biting rate, their daily survival rate, and their incubation period. It has been constructed for 0.5-degree-by-0.5-degree grid-cells globally. **Source**: Kiszewski *et al.* (2004).

- **Railway contact**: indicator variable that equals one if any part of the railway network was built on land historically inhabited by the ethnic group. **Source**: Nunn and Wantchekon (2011) using information on the location of railway lines in the first decade of the twentieth century from Company (1911).

- **Slave exports, per capita**: estimates of the number of slaves taken from each ethnic group disaggregated at the ethnicity level. These estimates were constructed by combining data on the total number of slaves shipped from all ports and regions of Africa with data on the slaves' ethnic identities. The estimates cover Africa's transatlantic and Indian Ocean slave trades between 1400 and 1900. **Source**: Nunn (2008).

Geographic Characteristics

- **Accumulated temperature in the year**: accumulated temperature or temperature sums are calculated for each grid cell by accumulating daily average temperatures for days when average tempature is above a certain threshold temperature. **Source**: Global Agro-Ecological Zones data.

- **Annual precipitation level**: the annual precipitation level data refers to total yearly precipitation. The model used to build this data has been applied considering the baseline period 1961-1990. A detailed description of calculation procedures used to build this data can be found in the GAEZ v.3.0 Global Agro Ecological Zones - Model Documentation (Fischer *et al.*, 2000). **Source**: Global Agro-Ecological Zones data.

- **Average elevation**: in meters. **Source**: Nunn (2008) using data from Parker (1997).

- **Distance to the capital**: the distance is computed by the authors using ArcGIS.

- **Distance to the coast**: the distance to the coast is identified by the authors using the Proximity Utility in ArcGIS.

- **Number of agriculture growing days per year**: number of days during the year when temperature regime and moisture supply are conducive to crop growth and development. This period is also termed the "length of the growing period" (LGP). It is a proxy for the agroclimatic potential productivity of land. The LGP is determined based on prevailing temperatures and water balance calculations for a reference crop. **Source**: Global Agro-Ecological Zones data.

- **Population density in 2005**: population density of the respondent's neighborhood. **Source**: Afrobarometer (2005).

- **Share of land within 10 km of water**: in percent. **Source**: Nunn (2010) using data from the Digital Chart of the World (DCW).

- **Suitability for rainfed crops**: rainfed suitability has been calculated for nine crop groups that are important to most farming systems in developing countries, namely cereals, fibre crops, oil crops, pulses, roots and tubers, stimulants, sugar crops, tree fruits and vegetables. The algorithm examines in each gridcell all the crop types belonging to a particular crop group. Among these it determines the crop type that maximizes agronomic suitability. **Source**: Global Agro-Ecological Zones data.

B.1.6 Newspaper Market

Newspaper Data The cross-country newspaper dataset we build relies on various sources:

- **Tudesq (1995)**: *Feuilles d'Afrique: étude de la presse de l'Afrique sub-saharienne*.

- **Daubert (2009)**: *La presse écrite d'Afrique francophone en question: essai nourri par l'essor de la presse française*.

- The **Standing Conference on Library Material on Africa** (SCOLMA): it provides an inventory of the available African newspapers in archives collected in 1973.

- The ***Directory of African Media*** (Maja-Pearce, 1996): digitized by the authors.

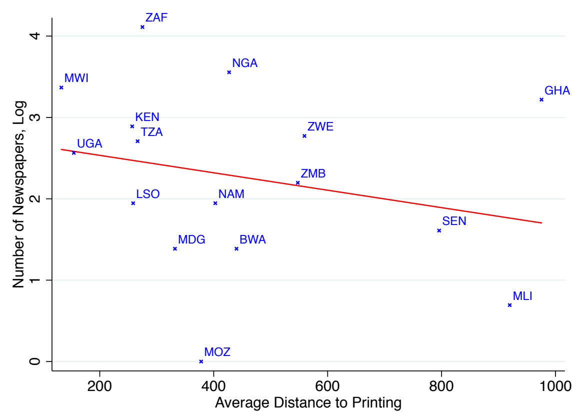
- The ***African book world and press: a directory*** (Zell, 1980): digitized by the authors.

- The ***Willings press guide*** (Redman and Group, 1993, 2003, 2012): digitized by the authors (one issue every ten years).

- **ICON**: using a web-spider, we collect all the data from the *Icon database* which provides information (first and last date published, title and frequency) on newspapers around the world. This information comes from all the records available in a precise set of institutions: the British Library, the Center for Research Libraries, Harvard University, the Library of Congress, the Library and Archives of Canada, the New York Public Library, the New York State Library, the Online Computer Library Center Inc., the University of Florida, the University of Illinois at Urbana-Champaign, the University of North Carolina at Chapel Hill, the University of Southern California, the University of Washington.

- **Readex**: We collect the summary data from the *Readex database*. Over several decades, Readex has published many of the most widely used collections of primary source research materials in academic libraries, first as Readex Microprint Corporation and since 1984 as a division of NewsBank. These digital collections include information for 40 African newspapers from 1800 to 1922.[1]

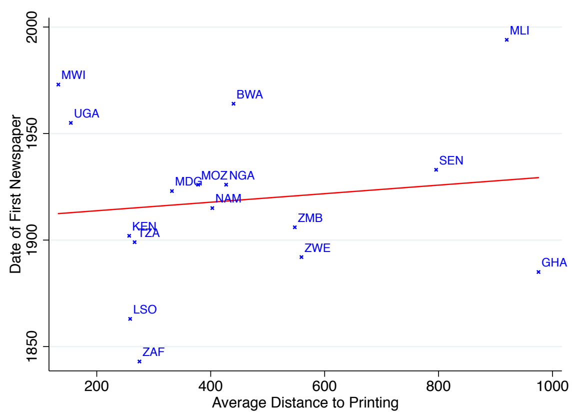
We merge the information from all these datasets/books together to build a consistent database of African newspapers through history. This dataset is a panel from 1800 to 2012 with the number of newspapers published each year in each sub-Saharan country and their date of creation. One caveat of this dataset is that some newspapers (especially small local newspapers) may be missing. However we think that it provides an interesting overview of the state of the newspaper market and of its evolution over time.



Notes: The x-axis represents the country average distance of Afrobarometer to the closest mission with printing press. The y-axis represents the country total number of newspapers in the dataset. Historical newspaper supply data is described in the Appendix, section A.

Figure B.5: *Distance to the Printing Press and Number of Newspapers*

[1] http://www.readex.com



Notes: The x-axis represents the country average distance of the villages in the Afrobarometer to the closest mission with a printing press. The y-axis represents the publication date of the first newspaper in the country. Historical newspaper supply data is described in the Appendix, section A

Figure B.6: *Distance to the Printing Press and Publication Date of the First Newspaper*

Table B.1: *Variables from Afrobarometer, Description*

	Type	Description
Outcomes		
Register	BV	Respondent registered for previous elections
Turnout	BV	Respondent voted at previous elections
Actions	BV	Respondent takes actions as citizens (attends to local meetings, joins others to raise an issue or attends to marches)
Listen	BV	Respondent feels people listen to him for political discussions
Satisfaction	BV	Respondent is satisfied with the country's democratic environment
Read News	BV	Respondent reads news on a monthly basis
Listen News	BV	Respondent listens to the news on the radio at least once a month
Watch News	BV	Respondent watches the news on TV at least once a month
Controls		
Education	DI	Level of education from none (0) to graduate studies (9)
Cash Constraints	DI	How often respondent has gone without cash income in the year from never (0) to always (4).
Water Constraints	DI	How often respondent has gone without enough clean water for home use in the year from never (0) to always (4).
Protestant Today	BV	Individual is Protestant
Urban	BV	Individual lives in an urban area

Notes: DI refers to *Discrete Index*, BV to *Binary Variable*

B.1.7 Descriptive Statistics

Table B.2: *Summary Statistics, Afrobarometer Data*

	All Sample		150km	
	Mean	sd	Mean	sd
Read News	0.331	0.471	0.355	0.479
Listen News	0.858	0.349	0.857	0.350
Watch News	0.451	0.498	0.443	0.497
Education	2.997	1.998	3.176	1.919
Female	0.500	0.500	0.501	0.500
Age	36.519	14.680	36.465	14.698
Cash Constraints	2.099	1.345	2.065	1.350
Water Constraints	1.168	1.397	1.107	1.365
Observations	18469		13286	

Table B.3: *Historical and Geographical Characteristics of Printing Presses With and Without a Publication Record*

	No Publication	Publication	Diff/se
Geographic Characteristics			
Accumulated Temp /1000	15.320	11.582	3.738
			(5.989)
Annual Precipitation/ 1000	1.317	1.434	-0.117
			(0.306)
Suitability for Rainfed Crops	5.750	4.000	1.750*
			(0.704)
Number of Growing Days / 100	1.876	2.429	-0.553
			(0.344)
Distance to Capital, 100 km	2.497	2.773	-0.275
			(0.855)
Distance to the Coast, 100 km	1.307	3.828	-2.521*
			(1.102)
Malaria Ecology	7.618	12.302	-4.685
			(3.609)
Historical Characteristics			
Slave Exports, per capita	0.058	0.032	0.026
			(0.047)
Railway Contact	0.083	0.125	-0.042
			(0.122)
Explorer Contact	0.250	0.312	-0.062
			(0.179)
Initial Population Density	17.611	10.872	6.739
			(8.418)
Distance to 1400 City, 100 km	6.097	7.624	-1.527
			(1.678)
Distance to 1800 City, 100 km	8.963	12.010	-3.047
			(3.203)
Observations	28		

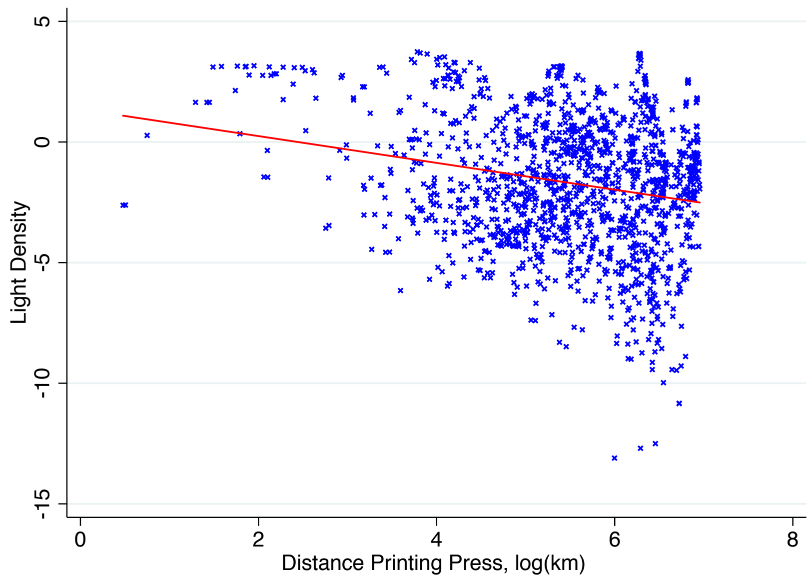
Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table compares geographical and historical characteristics of missions with a printing press depending on whether they had a publication record in 1923 or not. Column 1 presents the results for missions with no publication record. Column 2 presents the results for missions with a publicatin record. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Online Appendix.

Table B.4: *Investments of Printing Presses With and Without a Publication Record*

	No Publication	Publication	Diff/se
Mission Characteristics			
Arrival Date	1866	1876	-10
			(10)
Bible Society	0.58	0.19	0.40
			(0.23)
Number of Native Workers	2.58	1.19	1.40
			(2.62)
Total Population	431	400	31
			(230)
Investment in Education			
Schools	2.33	1.12	1.21
			(0.94)
Number of Students	408	389	19
			(228)
Schools per Student (%)	2.52	0.47	2.05
			(1.44)
Teachers per Student (%)	12.44	24.00	-11.57
			(15.44)
Investments in Health			
Health Facilities	1.67	1.31	0.35
			(0.68)
Physicians per Capita (%)	0.04	1.63	-1.59
			(1.81)
Health Facilities per Capita (%)	0.50	3.66	-3.16
			(3.60)
Observations	28		

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table compares investments' of missions with a printing press depending on whether they had a publication record in 1923 or not. Column 1 presents the results for missions with no publication record. Column 2 presents the results for missions with a publicatin record. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Online Appendix.

B.2 Additional Results



Notes: The graph plots the average light density in a 10 km buffer around each town (in logs) over the distance to the printing press (in logs). The sample is restricted to towns located closer than 150 km away to a mission.

Figure B.7: *Proximity to a Printing Press and Light Density*

Table B.5: *Distance to a Printing Press and Newspaper Readership, Baseline OLS Estimation, Reporting all the Covariates*

	(1)	(2)	(3)	(4)	(5)
	All	All	200km	150km	100 km
	b/se	b/se	b/se	b/se	b/se
Distance Printing Press	-0.014**	-0.015**	-0.013*	-0.015**	-0.013*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Distance Mission		0.004	0.005	0.000	0.001
		(0.005)	(0.006)	(0.006)	(0.007)
Education	0.065***	0.065***	0.066***	0.063***	0.062***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
Urban	0.105***	0.105***	0.110***	0.110***	0.099***
	(0.010)	(0.010)	(0.012)	(0.012)	(0.013)
Clinic in Town	0.028***	0.028***	0.033***	0.034***	0.042***
	(0.008)	(0.008)	(0.009)	(0.010)	(0.011)
Protestant Today	-0.001	-0.001	-0.002	0.007	0.003
	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)
Catholic Now	-0.009	-0.009	-0.007	0.004	0.000
	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)
Water Constraints	0.005*	0.005*	0.003	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Cash Constraints	-0.020***	-0.020***	-0.020***	-0.020***	-0.018***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Age	-0.002*	-0.002*	-0.002	-0.002	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age Squared	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.070***	-0.070***	-0.072***	-0.072***	-0.077***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)
Log Distance Capital City	-0.007	-0.007	-0.008	-0.008	-0.010*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)

Ethnic Pop density 2005	-0.005	-0.006	-0.009	-0.007	-0.010
	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)
Slave Export	-0.003	-0.002	0.016*	0.014	0.015
	(0.007)	(0.007)	(0.008)	(0.009)	(0.010)
Distance to the Coast	0.000	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Initial Population Density	0.006	0.006	0.007	0.001	0.002
	(0.007)	(0.006)	(0.007)	(0.008)	(0.009)
Pop Density 2005	0.001	0.002	0.002	0.001	0.000
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)
Ethnic Initial Pop Density	-0.001	-0.001	0.002	0.000	0.003
	(0.006)	(0.006)	(0.008)	(0.009)	(0.009)
Malaria	0.000	0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Elevation, over 100	0.005**	0.005**	0.005*	0.004*	0.005*
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	15086	15086	12405	10970	9383
Baseline Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No	No
Clusters	1809	1809	1456	1315	1136
R2	0.360	0.360	0.357	0.353	0.357
F-Statistic	205.5	201.6	185.4	174.9	158.3

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village-, and ethnicity-level controls described in the text. All specifications include country fixed effects. In columns 1 and 2 we present results for the entire sample. In columns 3 to 5 the sample is sequentially restricted to individuals living 200 km (column 3), 150 km (column 4) and 100 km (column 5) away from a historical mission settlement.

Table B.6: *Distance to a Printing Press and Newspaper Readership, Baseline OLS Estimation, Standardized (beta) Coefficients*

	(1) All beta/se	(2) All beta/se	(3) 200km beta/se	(4) 150km beta/se	(5) 100 km beta/se
Distance Printing Press	-0.032**	-0.034**	-0.028*	-0.034**	-0.031*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Distance Mission		0.010	0.012	0.001	0.003
		(0.005)	(0.006)	(0.006)	(0.007)
Education	0.274***	0.274***	0.263***	0.250***	0.243***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
Urban	0.107***	0.107***	0.110***	0.110***	0.100***
	(0.010)	(0.010)	(0.012)	(0.012)	(0.013)
Clinic in Town	0.029***	0.029***	0.034***	0.036***	0.044***
	(0.008)	(0.008)	(0.009)	(0.010)	(0.011)
Protestant Today	-0.001	-0.001	-0.002	0.007	0.003
	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)
Catholic Now	-0.009	-0.008	-0.007	0.004	0.000
	(0.009)	(0.009)	(0.010)	(0.010)	(0.011)
Water Constraints	0.013*	0.013*	0.008	0.005	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Cash Constraints	-0.056***	-0.056***	-0.056***	-0.057***	-0.050***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Age	-0.055*	-0.055*	-0.059	-0.057	-0.071*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age Squared	0.042	0.041	0.044	0.043	0.059
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.074***	-0.074***	-0.075***	-0.075***	-0.080***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)
Log Distance Capital City	-0.022	-0.022	-0.022	-0.024	-0.031*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)

Ethnic Pop density 2005	-0.014	-0.014	-0.021	-0.018	-0.023
	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)
Slave Export	-0.007	-0.005	0.036*	0.032	0.035
	(0.007)	(0.007)	(0.008)	(0.009)	(0.010)
Distance to the Coast	0.015	0.010	-0.001	-0.004	-0.023
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Initial Population Density	0.019	0.018	0.021	0.001	0.006
	(0.007)	(0.006)	(0.007)	(0.008)	(0.009)
Pop Density 2005	0.005	0.007	0.008	0.003	0.002
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)
Ethnic Initial Pop Density	-0.004	-0.004	0.006	0.000	0.006
	(0.006)	(0.006)	(0.008)	(0.009)	(0.009)
Malaria	0.004	0.003	0.000	-0.002	-0.009
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Elevation, over 100	0.054**	0.055**	0.057*	0.052*	0.055*
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	15086	15086	12405	10970	9383
Baseline Controls	Yes	Yes	Yes	Yes	Yes
Additional Controls	No	No	No	No	No
Clusters	1809	1809	1456	1315	1136
R2	0.360	0.360	0.357	0.353	0.357
F-Statistic	205.5	201.6	185.4	174.9	158.3

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. The baseline controls are the individual-, village-, and ethnicity-level controls described in the text. All specifications include country fixed effects. In columns 1 and 2 we present results for the entire sample. In columns 3 to 5 the sample is sequentially restricted to individuals living 200 km (column 3), 150 km (column 4) and 100 km (column 5) away from a historical mission settlement.

Table B.7: *Missions Characteristics in sub-Saharan Africa and "Society PP", OLS Estimation*

	(1) Society PP b	se
Geographic Characteristics		
Accumulated Temp /1000	-0.000	(0.000)
Annual Precipitation/ 1000	-0.014	(0.033)
Suitability for Rainfed Crops	-0.004	(0.006)
Number of Growing Days / 100	0.001	(0.003)
Distance to Capital, 100 km	-0.008	(0.007)
Distance to the Coast, 100 km	-0.004	(0.004)
Malaria Ecology	0.005	(0.004)
Historical Characteristics		
Slave Exports, per capita	-0.012	(0.019)
Railway Contact	-0.036	(0.034)
Explorer Contact	0.006	(0.023)
Initial Population Density	0.000	(0.000)
Distance to 1400 City, 100 km	-0.006	(0.006)
Distance to 1800 City, 100 km	0.002	(0.002)
Mission Characteristics		
Arrival Date	0.001	(0.001)
Bible Society	-0.076	(0.072)
Number of Native Workers	0.000	(0.002)
Total Population	-0.000	(0.002)
Investment in Education		
Schools	0.030	(0.029)
Number of Students	0.000	(0.002)
Schools per Student (%)	0.011	(0.011)
Teachers per Student (%)	-0.000	(0.000)
Investments in Health		
Health Facilities	0.009	(0.012)
Physicians per Capita (%)	0.000	(0.003)
Health Facilities per Capita (%)	-0.004	(0.004)
Observations	371	
Country FE	Yes	
Clusters (Society)	48	
R2	0.209	

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. This table reports OLS estimates of mission-level regression of the share of missions from the mission's society equipped with printing presses in all the regions of the world outside sub-Saharan Africa on mission characteristics, investments, geographical and historical characteristics. The unit of observation is a mission. Standard errors are clustered by society.

Table B.8: *Missions' Denomination*

	No Printing	Printing	Total
Anglican	25.2	29.6	25.3
Baptist	2.2	11.1	2.5
Disciples of Christ	0.3	0.0	0.3
Free Church	1.5	3.7	1.6
Independent	5.7	0.0	5.5
Lutheran	27.5	14.8	27.0
Methodist	17.0	14.8	16.9
Multidenominational	4.6	0.0	4.4
Presbyterian	8.3	22.2	8.9
Quaker	0.6	0.0	0.6
United Brethern in Christ	4.6	3.7	4.6
Undenominational	1.2	0.0	1.2
United Church	1.2	0.0	1.2
Total	100.0	100.0	100.0

Notes: The table reports the share of the missions in our sample from each denomination. In Column 1 we report this share for the missions without printing press; in Column 2 for the missions with a printing press; and in Column 3 for all the missions taken together.

Table B.9: *Determinants of the Probability of Having a Printing Press at the Mission Level, OLS Estimation*

	(1) Mission PP b	se
Society PP	0.088**	(0.033)
Geographic Characteristics		
Accumulated Temp /1000	-0.001	(0.001)
Annual Precipitation/ 1000	0.154***	(0.054)
Suitability for Rainfed Crops	-0.009	(0.012)
Number of Growing Days / 100	-0.013***	(0.004)
Distance to Capital, 100 km	0.002	(0.006)
Distance to the Coast, 100 km	0.007	(0.004)
Malaria Ecology	0.005	(0.003)
Historical Characteristics		
Slave Exports, per capita	-0.034**	(0.015)
Railway Contact	-0.031	(0.025)
Explorer Contact	0.024	(0.043)
Initial Population Density	-0.000**	(0.000)
Distance to 1400 City, 100 km	0.004	(0.003)
Distance to 1800 City, 100 km	-0.000	(0.002)
Mission Characteristics		
Arrival Date	-0.001	(0.001)
Bible Society	0.005	(0.057)
Number of Native Workers	-0.014**	(0.006)
Total Population	0.014**	(0.006)
Investment in Education		
Schools	0.015	(0.024)
Number of Students	-0.014**	(0.006)
Schools per Student (%)	-0.007*	(0.004)
Teachers per Student (%)	0.000	(0.001)
Other Investments		
Health Facilities	0.034	(0.032)
Physicians per Capita (%)	0.006	(0.013)
Health Facilities per Capita (%)	0.005	(0.004)
Observations	371	
Country FE	Yes	
Clusters (Society)	48	
R2	0.373	

Notes: * p<0.10, ** p<0.05, *** p<0.01. This table reports OLS estimates of mission-level regression of a binary variable indicating whether the mission has a printing press on mission characteristics, investments, geographical and historical characteristics as well as on the share of missions from the mission's society equipped with printing presses in all the regions of the world outside sub-Saharan Africa. The unit of observation is a mission. Standard errors are clustered by society.

Table B.10: *Impact of the Proximity to a Printing Press, IV Estimation: 40 km Radius*

	(1)	(2)	(3)
	200km	150km	100km
Panel A: Dependent Variable is Distance Printing Press			
Village Printing (40)	-0.609**	-0.591**	-0.444*
	(0.199)	(0.219)	(0.233)
Panel B: Dependent Variable is News Readership			
Distance Printing Press	-0.050**	-0.046**	-0.049**
	(0.019)	(0.019)	(0.022)
Observations	11925	10583	9059
Baseline Controls	Yes	Yes	Yes
Clusters	1401	1267	1093
R2 First Stage	0.629	0.627	0.625
F First Stage	51.390	52.433	49.811

Notes: * p<0.10, ** p<0.05, *** p<0.01. The unit of observation is an individual. Standard errors in parentheses are clustered by village. The table reports the first and second stage of the IV estimation of the impact of the distance to a printing press on newspaper readership. The distance to a printing press is instrumented by Village Printing$_j(40)$. The construction of the variables “Village Printing$_j(50)$" and "Denomination PP$_m$" is described in more details in the text. The controls are the individual-, village-, ethnicity- and mission-level controls described in the text.

Table B.11: *Impact of the Proximity to a Printing Press, IV Estimation: 60 km Radius*

	(1)	(2)	(3)
	200km	150km	100km
Panel A: Dependent Variable is Distance Printing Press			
Village Printing (60)	-0.498***	-0.479**	-0.386**
	(0.150)	(0.166)	(0.181)
Panel B: Dependent Variable is News Readership			
Distance Printing Press	-0.041**	-0.037*	-0.038*
	(0.019)	(0.019)	(0.022)
Observations	11925	10583	9059
Baseline Controls	Yes	Yes	Yes
Clusters	1401	1267	1093
R2 First Stage	0.639	0.635	0.630
F First Stage	58.725	62.539	58.945

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The unit of observation is an individual. Standard errors in parentheses are clustered by village. The table reports the first and second stage of the IV estimation of the impact of the distance to a printing press on newspaper readership. The distance to a printing press is instrumented by Village $\text{Printing}_j(60)$. The construction of the variables "Village $\text{Printing}_j(50)$" and "Denomination PP_m" is described in more details in the text. The controls are the individual-, village-, ethnicity- and mission-level controls described in the text.

Table B.12: *Instrumental Variable: Distance to the Printing Press and Light Density: 40 km Radius*

	(1)	(2)	(3)
	200km	150km	100km
Panel A: Dependent Variable is Distance Printing Press			
Village Printing (40)	-0.828***	-0.805***	-0.768***
	(0.240)	(0.241)	(0.227)
Panel B: Dependent Variable is Light Density			
Distance Printing Press	-0.597**	-0.681**	-0.647**
	(0.263)	(0.291)	(0.304)
Observations	1428	1293	1118
Baseline Controls	Yes	Yes	Yes
Clusters	346	343	335
R2 First Stage	0.804	0.800	0.800
F First Stage	140.623	110.505	58.996

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports IV estimates. The unit of observation is the town. The controls are the average individual (per village)-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the log of average light density in a 10km buffer around the town.

Table B.13: *Instrumental Variable: Distance to the Printing Press and Light Density: 50 km Radius*

	(1) 200km	(2) 150km	(3) 100km
Panel A: Dependent Variable is Distance Printing Press			
Village Printing (50)	-0.864***	-0.860***	-0.836***
	(0.199)	(0.199)	(0.191)
Panel B: Dependent Variable is Light Density			
Distance Printing Press	-0.545**	-0.608**	-0.570*
	(0.252)	(0.279)	(0.294)
Observations	1428	1293	1118
Baseline Controls	Yes	Yes	Yes
Clusters	346	343	335
R2 First Stage	0.806	0.802	0.802
F First Stage	142.030	111.244	91.390

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports IV estimates. The unit of observation is the town. The controls are the average individual (per village)-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the log of average light density in a 10km buffer around the town.

Table B.14: *Instrumental Variable: Distance to the Printing Press and Light Density: 60 km Radius*

	(1)	(2)	(3)
	200km	150km	100km
Panel A: Dependent Variable is Distance Printing Press			
Village Printing (60)	-0.851***	-0.879***	-0.874***
	(0.189)	(0.189)	(0.194)
Panel B: Dependent Variable is Light Density			
Distance Printing Press	-0.517**	-0.557**	-0.511*
	(0.245)	(0.269)	(0.285)
Observations	1428	1293	1118
Baseline Controls	Yes	Yes	Yes
Clusters	346	343	335
R2 First Stage	0.807	0.803	0.803
F First Stage	143.773	117.279	66.379

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports IV estimates. The unit of observation is the town. The controls are the average individual (per village)-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the log of average light density in a 10km buffer around the town.

B.3 Robustness Checks

B.3.1 Matching Strategy

Using a Logit model, we regress the binary variable indicating whether missions are endowed with a printing press on all the observable characteristics available at the mission level (these observables correspond to the variables reported in Tables 2.3 and 2.4). From this regression we compute the propensity score, which is the estimated probability of having a printing press. We then match each mission with a printing press to the mission with the closest propensity score using a one-to-one matching. The missions matched are extremely similar to the missions with a printing press but had not imported it in 1903. We call the sample of missions similar to those with a printing press but without a printing press $\overline{PP}$. The sample of missions with a printing press is called PP. Tables B.15 and B.16 show respectively the results of the regression from which we compute the propensity score and the balance check comparing samples PP and $\overline{PP}$. There are no significant differences between the two samples.

Each city from the Afrobarometer is then associated to the closest mission in the sample $\left\{\overline{PP} \cup PP\right\}$. We define a binary variable "Treat" equal to one if a city is associated to a mission that did import the printing press and to zero otherwise. We construct the treatment area as follows: we decompose the map of Africa as a Voronoi diagram using the missions in $\left\{\overline{PP} \cup PP\right\}$ as generators (Figure B.8). A Voronoi Diagram is a way of dividing space into a number of regions (Thiessen Polygons). A set of points (called seeds, sites, or generators) is specified beforehand and for each seed there is a corresponding region consisting of all the points closer to that seed than to any other. For each Thiessen Polygon, the binary variable "Printing Treatment" indicates whether the generator point (mission) was indeed endowed with a printing press.

Equation (B.1) describes the identification equation:

$$\begin{aligned} \text{News}_{ijec} = {} & \delta_1 \text{Distance Mission}_j + \delta_2 \text{Treat}_j \\ & + \delta_3 \text{Treat}_j \times \text{Distance Mission}_j \\ & + \boldsymbol{X_i'\beta_2} + \boldsymbol{Y_j'\beta_3} + \boldsymbol{Z_e'\beta_4} + \delta_c + u_{ijec} \end{aligned} \tag{B.1}$$

"Distance Mission" is the distance from town j to the closest mission station in the sample $\left\{\overline{PP} \cup PP\right\}$. "Treat * Distance Mission" is the crossed effect of "Treat" and "Distance Mission". The controls are the same as in Table 2.5b.

Table B.17 gives the results of the estimation of equation (B.1). The effect of proximity to the

Table B.15: *Estimation of the Propensity Score: Importing the Printing Press and Missions Characteristics, Logit*

	(1)	
	Mission PP	
	b	se
Annual Precipitation level	0.000**	(0.000)
Suitability for Rainfed Crops	-0.016	(0.216)
Number of agriculture growing days	-0.000**	(0.000)
Accumulated Temperature	-0.000	(0.000)
Historical Characteristics		
Distance to 1400 City, 100 km	0.046	(0.073)
Distance to 1800 City, 100 km	-0.048	(0.040)
Mission Characteristics		
Bible Society	-0.196	(0.728)
Number of Native Workers	-0.213**	(0.084)
Total Population	0.157***	(0.056)
Investment in Education		
Schools	0.261	(0.327)
Number of Students	-0.157***	(0.056)
Schools per Student (%)	0.129	(0.110)
Other Investments		
Health Facilities	0.323	(0.301)
Physicians per Capita (%)	0.065**	(0.029)
Health Facilities per Capita (%)	0.010	(0.040)
Observations	508	
Country FE	Yes	Yes
Clusters (Society)	64	
Pseudo R2	0.417	

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports the first stage of the matching strategy. This first stage estimates the propensity score at the mission-level. The propensity score is the estimated probability of importing the printing press from the logit regression of the binary variable indicating whether a mission imported the printing press on mission's historical and geographical characteristics as well as mission investments.

Table B.16: *Propensity Score Matching: Balancing Test*

	No printing	Printing	Diff/se
Annual Precipitation level	1235.559	1484.559	-249.000
			(243.329)
Suitability for Rainfed Crops	4.294	4.353	-0.059
			(0.586)
Number of agriculture growing days	196.412	240.000	-43.588
			(24.257)
Accumulated Temperature	16147.588	11601.765	4545.824
			(5797.209)
Historical Characteristics			
Distance to 1400 City, 100 km	7.764	6.886	0.878
			(1.825)
Distance to 1800 City, 100 km	12.401	9.555	2.846
			(3.107)
Mission Characteristics			
Bible Society	0.353	0.471	-0.118
			(0.228)
Number of Native Workers	0.000	2.941	-2.941
			(2.078)
Total Population	473.000	507.059	-34.059
			(301.932)
Investment in Education			
Schools	1.412	1.941	-0.529
			(0.926)
Number of Students	460.882	489.765	-28.882
			(300.122)
Schools per Student (%)	2.716	1.951	0.766
			(1.731)
Other Investments			
Health Facilities	1.294	1.647	-0.353
			(0.505)
Physicians per Capita (%)	1.596	1.533	0.063
			(2.074)
Health Facilities per Capita (%)	4.481	3.438	1.044
			(3.941)
Observations	34		

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table compares geographical and historical characteristics of missions with a printing press and the missions matched using the propensity score. Column 1 presents the results for missions without a printing press. Column 2 presents the results for missions with a printing press. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Online Appendix.

closest mission from $\left\{\overline{PP} \cup PP\right\}$ is also more robust if the closest mission did invest in a printing press. Interestingly, the magnitude of the effect is comparable to the one in the previous section.

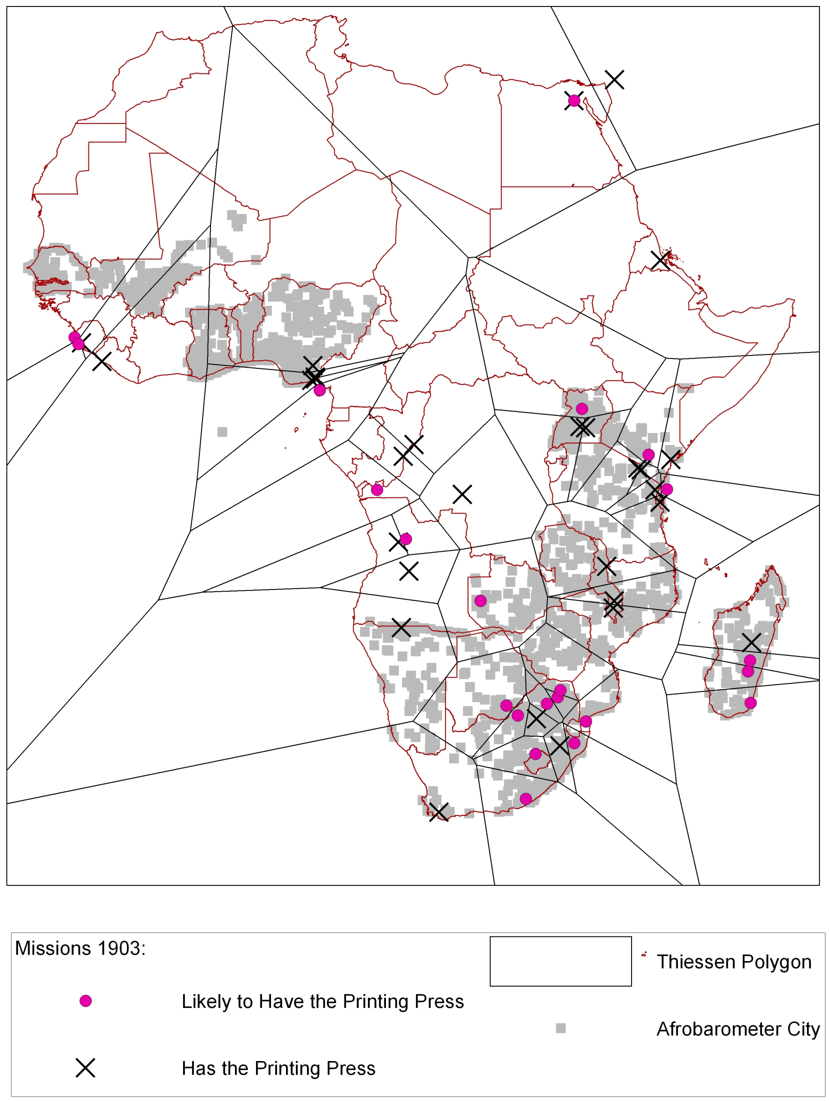


Figure B.8: *Voronoi Diagram of Africa using Historical Mission Settlements with the Printing Press and Similar to those with the Printing Press as Generators*

Table B.17: *Printing Press and Newspaper Readership, Controlling for Observables, Matching Estimation*

	(1) 200 km b/se	(2) 150 km b/se	(3) 100 km b/se
Treat * Distance Mission	-0.018*	-0.020*	-0.015
	(0.011)	(0.011)	(0.013)
Printing Treatment	0.111*	0.108*	0.080
	(0.060)	(0.062)	(0.067)
Distance Mission	0.001	-0.005	-0.008
	(0.010)	(0.011)	(0.012)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.360	0.357	0.363
F-Statistic	126.6	118.4	108.5

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in the text. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 2) and 100 km (Column 3) away from a historical mission settlement.

B.3.2 Selection on Observables

Suppose there is a set of unobservable explanatory variables W'. Since these variables are unobserved, they are not included in regression (2.1). The *proportional selection assumption* (PSA) states that $\delta C_{WX} = \frac{C_{W'X}}{V_{W'}}$. X is the treatment variable (here distance to the printing press), W is the set of observed covariates, $C_{W'X}$ is the covariance of W' and X and $V_{W'}$ is the variance of W'. δ is a measure of the relationship between C_{WX} and $C_{W'X}$. The PSA assumption is key in the approach as it states that the relationship between the observed covariates W and the treatment X is informative about the relationship between the unobserved covariates W' and X, from which the bias is coming.

Consider the following three regressions:

$$\text{News} = \gamma X + W + W' + \varepsilon_{\text{max}} \tag{M-max}$$

$$\text{News} = \xi X + M + \varepsilon_1 \tag{M-1}$$

$$\text{News} = \Lambda X + W + \varepsilon_2 \tag{M-2}$$

Let R_{max} be the R-squared of the full model regression (M-max). R_2 is the R-squared of the regression (M-2) including all the observed covariates. R_1 is the R-squared of regression (M-1) including only a restricted set of covariates M. M is a set of observed controls that do not have a related unobserved component and are orthogonal to W and W'(Oster, 2013).

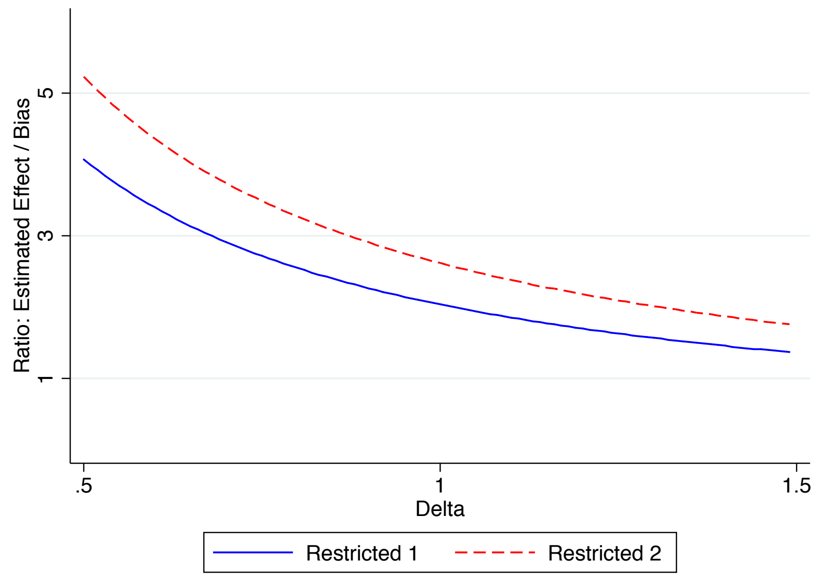
According to Oster (2013), under the PSA and when δ is close to one, $B(\delta) = \delta \frac{(\xi - \Lambda)(R_{\text{max}} - R_2)}{R_2 - R_1}$ is (i) equal to the unobserved bias if $\delta = 1$; (ii) a close upper bound on the bias if $\delta < 1$; (iii) and a close lower bound on the bias if $\delta > 1$.[2]

We can the bias due to unobserved variables from the movements in the treatment effect due to the added controls using the ratio $B(\delta)$. However, to compute the ratio it would be necessary to know the true value of R_{max}. Because there is probably some randomness in the movements of the outcome, it is unlikely that R_{max} is equal to one. Oster (2013) uses the R-squared from different randomized experiments as a measure of R_{max}. We cannot use the same approach because we analyze historical events. In the literature of the long-term consequences of historical events, in particular of Protestantism (Becker and Woessmann, 2009) and the diffusion of the printing press (Dittmar, 2011) the R-squared rarely exceed 0.65 and are usually close to 0.5. In our regressions, the R-squared never exceed 0.5. Thus, in our computations we choose 0.6 and 0.7, two conservative

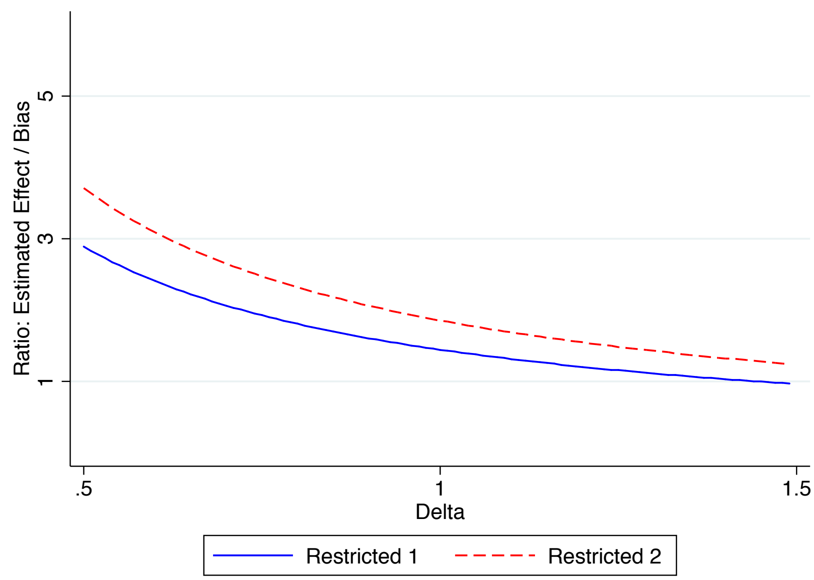
[2] If W is selected randomly from $\{W, W'\}$, then $\delta = 1$. If W is the most important set of controls from $\{W, W'\}$ then $\delta < 1$.

values of $R_{\max}$.

Figure B.9a (respectively B.9b) plots the ratio of the treatment as given in Table 2.5b over the bias $B(\delta)$ for different values of δ with $R_{\max} = 0.6$ (respectively $R_{\max} = 0.7$). In each graph, two different restricted sets of controls M are chosen. The first set only includes country fixed effects; the second one includes country fixed effects, age, age squared, gender, distance to the closest mission, and distance to the capital city. All the regressions restrict the sample to cities located in 150-km radius of a mission. In all the specifications, for all the values of δ and the two values of $R_{\max}$, the ratio of the treatment over the bias $B(\delta)$ is higher than one. These results make it unlikely that the entire estimated effect of the distance to the printing press is driven by unobserved variables.



(a) $R_{\max}$ = *0.6*



(b) $R_{\max}$ = *0.7*

Notes: Each graph plots the ratio of the treatment over the bias $B(\delta)$ using two different sets of restricted controls M. The first set ("Resricted 1") only includes country fixed effects. The second set ("Restricted 2") includes country fixed effects, age, age squared, gender, distance to the closest mission, and distance to the capital city. Figure B.9a (respectively B.9b) uses the value $R_{\max} = 0.6$ (respectively $R_{\max} = 0.7$) to compute $B(\delta)$.

Figure B.9: *Magnitude of the Treatment Relative to the Bias for Different Values of δ*

B.3.3 Additional Robustness Checks

Table B.18: *Printing Press and Newspaper Readership, All Distance Controls*

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.018**	-0.023***	-0.021**
	(0.009)	(0.009)	(0.009)
Distance Mission	0.008	0.003	0.002
	(0.007)	(0.007)	(0.008)
Distance Capital City	-0.008	-0.008	-0.014**
	(0.005)	(0.005)	(0.006)
Distance Coast	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Distance Health Facility	-0.013*	-0.011	-0.012
	(0.008)	(0.008)	(0.008)
Distance Any Schools	-0.014	-0.016	-0.019
	(0.012)	(0.012)	(0.012)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.359	0.356	0.361
F-Statistic	137.6	130.2	120.0

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more detail in the text. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 3) and 50 km (Column 3) away from an historical mission settlement.

Table B.19: *Printing Press and Newspaper Readership, Controlling for Observables, Probit Estimation*

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Read News			
Distance Printing Press	-0.060**	-0.077**	-0.071**
	(0.030)	(0.030)	(0.032)
Observations	12297	10876	9307
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1454	1313	1134
Pseudo R2	0.331	0.327	0.333

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports Probit estimates. The unit of observation is an individual. The dependent variable is newspaper readership nowadays. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more details in the text. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 3) and 100 km (Column 3) away from a historical mission settlement.

Table B.20: *Printing Press and Newspaper Readership, Controlling for Observables but not for Potential "Bad Controls"*

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.028***	-0.034***	-0.033***
	(0.011)	(0.011)	(0.012)
Observations	12508	11056	9449
Baseline Controls; Reduced	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.220	0.222	0.226
F-Statistic	68.67	64.30	58.67

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors in parentheses are clustered by village. The baseline controls do not include "bad controls" (namely contemporary possible outcomes: education, religion, water constraints, cash constraints, watching news on TV and listening the news on radio). All specifications include country fixed effects. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 3) and 100 km (Column 3) away from an historical mission settlement.

Table B.21: *Robustness Check: Distance to the Largest Missions*

	200km		150km		100km	
	(1)	(2)	(3)	(4)	(5)	(6)
	b/se	b/se	b/se	b/se	b/se	b/se
Distance Large Mission	-0.008	-0.009	-0.006	-0.008	-0.002	-0.003
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
Distance Printing Press		-0.019**		-0.024***		-0.021**
		(0.009)		(0.009)		(0.009)
Observations	12405	12405	10970	10970	9383	9383
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1456	1456	1315	1315	1136	1136
R2	0.359	0.359	0.355	0.356	0.361	0.361
F-Statistic	137.9	135.3	130.8	128.1	120.1	117.8

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more detail in the text. In Columns 1 to 6 the sample is sequentially restricted to individuals living 200 km (Columns 1 and 2), 150 km (Columns 3 and 4) and 100 km (Columns 5 and 6) away from a historical mission settlement.

Table B.22: *Printing Press and Newspaper Readership, Two-Way Clustering at the Mission Level*

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.018*	-0.023**	-0.021**
	(0.010)	(0.010)	(0.011)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Cluster 1: Village	1456	1315	1136
Cluster 2: Mission	358	356	348
R2	0.359	0.356	0.361
F-Statistic	78.17	83.36	94.56

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors are two-way clustered at the closest mission- and village-levels. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more detail in the text. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 3) and 100 km (Column 3) away from a historical mission settlement.

Table B.23: *Printing Press and Newspaper Readership, Former Bristish Colonies*

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.031***	-0.032***	-0.034***
	(0.010)	(0.009)	(0.010)
Observations	8760	7900	6948
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1025	938	839
R2	0.331	0.326	0.327
F-Statistic	132.3	116.3	107.0

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. The sample of countries is reduced to former British colonies. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more detail in the text. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 3) and 100 km (Column 3) away from a historical mission settlement.

Table B.24: *Falsification Test: Radio and Television*

	Radio News			TV News		
	(1)	(2)	(3)	(4)	(5)	(6)
	200km	150km	100km	200km	150km	100km
	b/se	b/se	b/se	b/se	b/se	b/se
Distance Printing Press	0.003	0.003	0.004	0.009	0.011	0.012
	(0.005)	(0.006)	(0.006)	(0.010)	(0.010)	(0.010)
Observations	12405	10970	9383	12405	10970	9383
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1456	1315	1136	1456	1315	1136
R2	0.111	0.118	0.124	0.423	0.431	0.433
F-Statistic	15.74	16.52	15.34	159.4	189.5	186.9

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. The table reports OLS estimates. The unit of observation is an individual. In Columns 1 to 3 the dependent variable is listening to the news on the radio at least once a month. In Columns 4 to 6 the dependent variable is watching the news on TV at least once a month. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more detail in the text. The sample is sequentially restricted to individuals living 200 km (Columns 1 and 4), 150 km (Columns 2 and 5) and 100 km (Columns 3 and 6) away from a historical mission settlement.

Appendix C

Appendix to Chapter 3

C.1 Proofs

C.1.1 Proof of Lemma 1

Assume $\mu > \frac{k}{1-w}$. First, we have $\frac{\mu-k}{w} > \mu > \theta^*$ which ensures $\pi_{t+1}(\theta) = \mu - w\theta - k > 0$ for all firms born at t which have quality $\theta < \theta^*$. Hence all such firms enter initially. Also, $\theta < \frac{k}{1-w}$ and $\rho' > 0$ imply that

$$E_t \pi_{t+s}(\theta) = (\rho(s-1) - w)\theta + (1 - \rho(s-1))\mu - k$$

is decreasing in s and $\lim_{s\to\infty} E_t \pi_{t+s} = (1-w)\theta - k < 0$ so all firms below θ^* expect to exit in finite time when their profits turn negative. The expected number of periods a firm θ born at t is active is $T(\theta)$ given by

$$\begin{aligned} [1-\rho(T(\theta-1))]\mu &> [w-\rho(T(\theta)-1)]\theta + k \\ \text{and} \qquad [1-\rho(T(\theta))]\mu &< [w-\rho(T(\theta))]\theta + k \end{aligned}$$

The highest quality type θ_T that exits after selling for T periods (or the lowest quality type that exits after selling for $T+1$ periods) is defined by $E_t \pi_{t+T+1}(\theta_T) = 0$, hence

$$\theta_T = \max\left\{\frac{k - [1-\rho(T)]\mu}{\rho(T) - w}, \theta_m\right\}$$

and θ_T is increasing with T:

$$\frac{\partial \theta_T}{\partial T} \propto \rho'(T)(\mu(1-w) - k) > 0 \text{ as } \rho' > 0 \text{ and } \mu > \theta^*$$

Second, firms with $\theta^* < \theta < \mu$ expect positive profits at all periods: they have $E_t\pi_{t+s}(\theta)$ monotonically decreasing from

$$\pi_{t+1}(\theta) = \mu - w\theta - k > \mu(1-w) - k > 0 \text{ since } \theta < \mu$$

to

$$\lim_{s\to\infty} E_t\pi_{t+s}(\theta) = \theta(1-w) - k > 0 \text{ since } \theta > \theta^*$$

Hence firms with $\theta^* < \theta < \mu$ always enter the market and stay until they are exogenously forced to exit.

Finally, firms with $\theta > \mu$ have increasing expected profits over time. They enter the market if and only if their expected intertemporal profits are positive, which requires:

$$E_t\left(\sum_{s=1}^{\infty}\delta^{s-1}\pi_{t+s}(\theta)\right) = \sum_{s=0}^{\infty}\delta^s\left[(\rho(s)-w)\theta + (1-\rho(s))\mu\right] - \frac{k}{1-\delta} > 0$$

or equivalently:

$$\theta > \frac{k - \mu(1-\delta)\sum_{s=0}^{\infty}\delta^s(1-\rho(s))}{(1-\delta)\sum_{s=0}^{\infty}\delta^s\rho(s) - w} \equiv \theta_H$$

Let us show that $\theta_H < \mu$. Rearranging:

$$\theta_H < \mu \text{ iff } \mu\left[(1-\delta)\sum_{s=0}^{\infty}\delta^s(1-\rho(s)) + (1-\delta)\sum_{s=0}^{\infty}\delta^s\rho(s)\right] > w\mu + k$$

or equivalently iff $\mu > \frac{k}{1-w}$ which holds by assumption in the high reputation case. Hence all firms with $\theta > \mu$ always export until they are hit by the exogenous shock.

C.1.2 Proof of Lemma 2

Assume $\mu < \frac{k}{1-w}$ and $\mu > k + w\theta_m$. First, consider firms with $\theta < \mu$ born at date t. Since their expected profits are decreasing with time, they are active in the first period if and only if $E_t\pi_{t+1}(\theta) = \mu - w\theta - k > 0$, which requires $\theta \le \frac{\mu-k}{w} \equiv \theta_L$. We can immediately check that $\mu < \frac{k}{1-w} \Leftrightarrow \theta_L < \mu$. Expected second-period profits are

$$E_t\pi_{t+2}(\theta) = (\rho(1)-w)\theta + (1-\rho(1))\mu - k < (1-w)\mu - k < 0$$

since $\theta < \mu$ and $\rho(1) > w$. Hence among firms with $\theta < \mu$, those with $\theta < \theta_L$ are active in the first period and exit afterwards, and those with $\theta_L \le \theta < \mu$ are never active.

Second, consider firms with $\mu \le \theta < \theta^*$. These firms have $E_t\pi_{t+1}(\theta) < 0$ since $\theta > \theta_L$, $E_t\pi_{t+s}(\theta)$

monotonically increasing in s since $\theta \geq \mu$, and $\lim_{s\to\infty} E_t\pi_{t+s}(\theta) < 0$ since $\theta < \theta^*$. Thus their expected profits are negative in all periods and they optimally exit after drawing their quality parameter.

Third, consider firms with $\theta > \theta^*$. These firms have $E_t\pi_{t+s}(\theta)$ monotonically increasing in s since $\theta > \mu$, and $\lim_{s\to\infty} E_t\pi_{t+s}(\theta) > 0$ since $\theta > \theta^*$. If they decide to be active in the first period, they expect to remain in the market as long as they survive the exogenous shock. However given $\theta > \theta_L$ they incur a loss in the initial periods. The condition for a firm of type $\theta > \theta^*$ to be active is for intertemporal expected profits to be positive, which requires $\theta > \frac{k-(1-A_\rho)\mu}{A_\rho - w} \equiv \theta_H$ as derived in the proof of Lemma 1, where we define $A_\rho \equiv (1-\delta)\sum_{s=0}^{\infty}\delta^s\rho(s)$. Finally,

$$\theta_H > \theta^* \Leftrightarrow \frac{k-(1-A_\rho)\mu}{A_\rho - w} > \frac{k}{1-w} \Leftrightarrow k\left(1-A_\rho\right) > \left(1-A_\rho\right)\mu\left(1-w\right)$$

which is equivalent to $\frac{k}{1-w} > \mu$ and holds by assumption in the low reputation case. Hence firms with $\theta^* \leq \theta \leq \theta_H$ are never active and firms with $\theta > \theta_H$ enter the export market and stay active.

C.1.3 Proof of Proposition 1

A HQE is a fixed point of $\overline{\theta}(.)$ where

$$\begin{aligned}
\overline{\theta}(\mu) &= \mu_0\left(\frac{1-\sum_{T=0}^{\infty}\delta^{T+1}\left(\left(\frac{\theta_m}{\theta_T}\right)^{\alpha-1}-\left(\frac{\theta_m}{\theta_{T+1}}\right)^{\alpha-1}\right)}{1-\sum_{T=0}^{\infty}\delta^{T+1}\left(\left(\frac{\theta_m}{\theta_T}\right)^{\alpha}-\left(\frac{\theta_m}{\theta_{T+1}}\right)^{\alpha}\right)}\right)\\
&= \mu_0\left(\frac{1+\sum_{T=\tilde{T}}^{\infty}\delta^{T}\left(\frac{\theta_m}{\theta_T}\right)^{\alpha-1}}{1+\sum_{T=\tilde{T}}^{\infty}\delta^{T}\left(\frac{\theta_m}{\theta_T}\right)^{\alpha}}\right)
\end{aligned}$$

and $\tilde{T}$ is the lowest value of T such that $\theta_T > \theta_m$.

Step 1: Let us show that $\overline{\theta}(\mu)$ is strictly decreasing in μ on $[\theta^*, \infty)$. We have

$$\begin{aligned}
\overline{\theta} &= \mu_0\left(\frac{1+K(\alpha-1)}{1+K(\alpha)}\right) \quad \text{where } K(\alpha) \equiv \sum_{T=\tilde{T}}^{\infty}\delta^{T}\left(\frac{\theta_m}{\theta_T}\right)^{\alpha}\\
\frac{\partial K(\alpha)}{\partial\alpha} &= \sum_{T=\tilde{T}}^{\infty}\delta^{T}\ln\left(\theta_m/\theta_T\right)\left(\frac{\theta_m}{\theta_T}\right)^{\alpha} < 0
\end{aligned}$$

Consider a change in one of the thresholds, θ_S, leaving unchanged all other thresholds. Then all else equal, average quality rises:

$$\begin{aligned}
\frac{\partial\overline{\theta}}{\partial\theta_S} &= \frac{\delta^S}{\theta_S}\left(\frac{\theta_m}{\theta_S}\right)^{\alpha-1}\left[\alpha\left(\frac{\theta_m}{\theta_S}\right)(1+K(\alpha-1))-(\alpha-1)(1+K(\alpha))\right] \\
&= \frac{\delta^S}{\theta_S}\left(\frac{\theta_m}{\theta_S}\right)^{\alpha-1}(1+K(\alpha))\left[\alpha\left(\frac{\theta_m}{\theta_S}\right)\frac{\overline{\theta}}{\mu_0}-(\alpha-1)\right] \\
&= \frac{\delta^S}{\theta_S}\left(\frac{\theta_m}{\theta_S}\right)^{\alpha-1}(1+K(\alpha))(\alpha-1)\left[\left(\frac{\overline{\theta}}{\theta_S}\right)-1\right]>0
\end{aligned}$$

which derives from $\overline{\theta}>\theta^*>\theta_S$ for all S in a HQE. An increase in μ lowers all θ_T given Assumption 1 and differentiating:

$$\frac{\partial\theta_T}{\partial\mu}=-\frac{1-\rho(T)}{\rho(T)-w}$$

Thus, in a HQE, $\overline{\theta}(\mu)$ is a decreasing function:

$$\frac{\partial\overline{\theta}}{\partial\mu}=\sum_{T=\tilde{T}}^{\infty}\frac{\partial\overline{\theta}}{\partial\theta_T}\frac{\partial\theta_T}{\partial\mu}<0$$

We have proved that $\overline{\theta}$ is strictly and continuously decreasing in μ on $[\theta^*,\infty)$.

Step 2: Let us show that $\lim_{\mu\to\infty}\frac{\overline{\theta}(\mu)}{\mu}<1$. As $\mu\to\infty$, it remains profitable for all firms to stay active, so firms of all qualities continue exporting until hit by the exogenous shock: $T(\theta)\to\infty$ for all θ. Therefore, $\lim_{\mu\to\infty}=\mu_0$ which is finite, so $\lim_{\mu\to\infty}\frac{\overline{\theta}(\mu)}{\mu}<1$.

By the fixed point theorem, we have established that if $\overline{\theta}(\theta^*)>\theta^*$, $\overline{\theta}(.)$ has a unique fixed point on (θ^*,∞), which proves Proposition 1.

Step 3: Derive the condition for $\overline{\theta}(\theta^*)>\theta^*$. At $\mu=\theta^*$, $\pi_t(\theta)<0$ for all $t>1$ and $\theta<\theta^*$. Then

$$\overline{\theta}(\theta^*)=\frac{\int_{\theta_m}^{\theta^*}\theta dG(\theta)+\frac{1}{1-\delta}\int_{\theta^*}^{\infty}\theta dG(\theta)}{\int_{\theta_m}^{\theta^*}dG(\theta)+\frac{1}{1-\delta}\int_{\theta^*}^{\infty}dG(\theta)}=\mu_0\left(\frac{1-\delta+\delta\left(\frac{\theta_m}{\theta^*}\right)^{\alpha-1}}{1-\delta+\delta\left(\frac{\theta_m}{\theta^*}\right)^{\alpha}}\right)$$

So $\overline{\theta}(\theta^*)>\theta^*$ is equivalent to $\mu_0\left(\frac{1-\delta+\delta\left(\frac{\theta_m(1-w)}{k}\right)^{\alpha-1}}{1-\delta+\delta\left(\frac{\theta_m(1-w)}{k}\right)^{\alpha}}\right)>\frac{k}{1-w}$, which after substituting for the value of μ_0 and rearranging yields the following condition:

$$\alpha\left(\frac{\theta_m(1-w)}{k}\right)+\frac{\delta}{1-\delta}\left(\frac{\theta_m(1-w)}{k}\right)^{\alpha}>\alpha-1$$

C.1.4 Proof of Proposition 2

A LQE is a fixed point of $\overline{\theta}(\mu)$ where:

$$\overline{\theta}(\mu) = \mu_0 \left(\frac{(1-\delta)\left(1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha-1}\right)+\left(\frac{\theta_m}{\theta_H}\right)^{\alpha-1}}{(1-\delta)\left(1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}\right)+\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}} \right)$$

Step 1: The sign of $\frac{\partial\overline{\theta}(\mu)}{\partial\mu}$ is indeterminate. Differentiate with respect to each threshold:

$$\begin{aligned}
\frac{\partial\overline{\theta}}{\partial\theta_L} &= \frac{\mu_o(\alpha-1)}{1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}+\frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}}\left(\frac{1}{\theta_L}\right)\left(\frac{\theta_m}{\theta_L}\right)^{\alpha-1}\left[1-\frac{\overline{\theta}}{\theta_L}\right]<0 \\
\frac{\partial\overline{\theta}}{\partial\theta_H} &= \frac{\frac{1}{1-\delta}\mu_o(\alpha-1)}{1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}+\frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}}\left(\frac{1}{\theta_H}\right)\left(\frac{\theta_m}{\theta_H}\right)^{\alpha-1}\left[\frac{\overline{\theta}}{\theta_H}-1\right]<0
\end{aligned}$$

$$\begin{aligned}
\frac{\partial\overline{\theta}}{\partial\mu} &= \frac{\partial\overline{\theta}}{\partial\theta_L}\frac{\partial\theta_L}{\partial\mu}+\frac{\partial\overline{\theta}}{\partial\theta_H}\frac{\partial\theta_H}{\partial\mu} = \frac{\mu_o(\alpha-1)}{1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}+\frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}} \times \ ... \\
... &\times \left[\left(\frac{\theta_m^{\alpha-1}}{\theta_L^{\alpha}}\right)\left[\frac{\overline{\theta}}{\theta_L}-1\right]\left(\frac{1}{w}\right)-\frac{1}{1-\delta}\left(\frac{\theta_m^{\alpha-1}}{\theta_H^{\alpha}}\right)\left[1-\frac{\overline{\theta}}{\theta_H}\right]\left(\frac{1-A_\rho}{A_\rho-w}\right)\right] \\
\frac{\partial\overline{\theta}}{\partial\mu} &< 0 \text{ iff } \frac{1}{1-\delta}\left(\frac{1}{\theta_H}\right)^{\alpha}\left[1-\frac{\overline{\theta}}{\theta_H}\right]\left(\frac{1-A_\rho}{A_\rho-w}\right) > \left(\frac{1}{\theta_L}\right)^{\alpha}\left[\frac{\overline{\theta}}{\theta_L}-1\right]\left(\frac{1}{w}\right)
\end{aligned}$$

This condition can be rewritten as

$$\delta > 1-\left(\frac{\theta_L}{\theta_H}\right)^{\alpha+1}\left(\frac{\theta_H-\overline{\theta}}{\overline{\theta}-\theta_L}\right)\left(\frac{(1-A_\rho)\,w}{A_\rho-w}\right)$$

Then note that the bracketed terms are $\frac{\theta_L}{\theta_H}=\frac{(\mu-k)(A_\rho-w)}{w(k-(1-A_\rho)\mu)}$ and $\frac{\theta_H-\overline{\theta}}{\overline{\theta}-\theta_L}=\frac{\frac{k-(1-A_\rho)\mu}{A_\rho-w}-\overline{\theta}}{\overline{\theta}-\frac{\mu-k}{w}}=\frac{w}{A_\rho-w}\left(1-\frac{A_\rho(\overline{\theta}-\mu)}{k-\mu+w\overline{\theta}}\right)$. Therefore $\overline{\theta}(\mu)$ decreases in μ when

$$\delta > 1-\left(\frac{\mu-k}{k-(1-A_\rho)\,\mu}\right)^{\alpha+1}\left(\frac{A_\rho-w}{w}\right)^{\alpha-1}\left(1-\frac{A_\rho\left(\overline{\theta}-\mu\right)}{k-\mu+w\overline{\theta}}\right)$$

and decreases in μ otherwise. The reason why $\overline{\theta}(\mu)$ needs not be monotonic over $[\theta_m,\theta^*]$ is that μ has opposite effects on $\overline{\theta}$ coming from θ_L and θ_H. Which effect dominates depends on the position of μ as well as the shape parameter α and the survival parameter δ. This non-monotonicity is what gives rises to the possibility of multiple equilibria.

Step 2: If $\mu=\theta_m$, no firm below θ^* finds it profitable to export, as national reputation imposes a first-period loss on all firms. Some firms with high enough θ have a positive NPV of future profits and enter. So since θ_m is the lower bound of the prior quality distribution, $\overline{\theta}(\theta_m) > \theta^* > \theta_m$.

Step 3: From the derivation of Proposition 1 we know that

$$\overline{\theta}(\theta^*) < \theta^* \Leftrightarrow \alpha\left(\frac{\theta_m(1-w)}{k}\right) + \frac{\delta}{1-\delta}\left(\frac{\theta_m(1-w)}{k}\right)^{\alpha} < \alpha - 1$$

So we have proved that if this condition holds, there is no HQE and there must be at least one LQE.

C.1.5 Proof of Result 1

In a LQE, the set of continuing firms is $[\theta_H, \infty)$ from the second period onwards, so the average price $\overline{p}^{lqe}_{t,t+s}$ of cohort t at time $t+s$ is given by:

$$\overline{p}^{lqe}_{t,t+s}(\overline{\theta}) = \begin{cases} \overline{\theta} & \text{if } s = 1 \\ \overline{\theta} + \rho(s)\left(\frac{\alpha}{\alpha-1}\theta_H - \overline{\theta}\right) & \text{if } s > 1 \end{cases}$$

As $\overline{\theta} < \theta_H$ in a LQE and $\rho(s)$ increases in s, it immediately follows that $\overline{p}^{lqe}_{t,t+s}$ increases with s.

In a HQE, the set of active firms of cohort t at time $t+s$ is $[\theta_{s-1}, \infty)$, and their average price is:

$$\overline{p}^{hqe}_{t,t+s}(\overline{\theta}) = \begin{cases} \overline{\theta} & \text{if } s = 1 \\ \overline{\theta} + \rho(s)\left(\frac{\alpha}{\alpha-1}\theta_{s-1} - \overline{\theta}\right) & \text{if } s > 1 \end{cases}$$

$\rho(s)$ and θ_{s-1} increase with s. Immediately following the entry of cohort t, $\overline{p}^{hqe}_{t,t+s}$ may fall with s if the distribution of θ has low variance (α high), such that $\frac{\alpha}{\alpha-1}\theta_1 > \mu$. In this case, there is initially a large mass of firms at the bottom of the distribution of continuing firms and their prices are falling. However, since $\mu < \frac{\alpha}{\alpha-1}\theta^*$, there is some finite s' such that for all $s \geq s'$, $\overline{p}^{hqe}_{t,t+s+1}(\overline{\theta}) > \overline{p}^{hqe}_{t,t+s}(\overline{\theta})$ and thus at each given point in time, the average unit price is higher for older cohorts of firms.

C.1.6 Proof of Result 2

The first part establishes that across cohorts, the fraction of active firms that exit per period is higher for lower quality firms. In a LQE, the hazard rate is 1 for firms below θ_L and $1-\delta$ for firms above θ_H. In a HQE, the hazard rate is $\frac{1-\delta}{1-\delta^T}$ for firms between θ_{T-1} and θ_T for all T, which is decreasing in T, and $1-\delta$ for firms above θ^*.

The second part states that the probability of exit, across quality levels, decreases with the age of a cohort. In a LQE, the hazard rate of cohort t at time $t+s$ is

$$h_{t,t+s}^{lqe} = \begin{cases} 1-\delta+\delta\frac{G(\theta_L)}{G(\theta_L)+1-G(\theta_H)} & \text{if } s=1 \\ 1-\delta & \text{if } s>1 \end{cases}$$

It falls from $t+1$ to $t+2$ and remains constant thereafter. In a HQE, the hazard rate of cohort t at $t+s$ is

$$h_{t,t+s}^{hqe} = 1-\delta+\delta\frac{G(\theta_s)-G(\theta_{s-1})}{1-G(\theta_{s-1})} = 1-\delta+\delta\left(1-\left(\frac{\theta_{s-1}}{\theta_s}\right)^{\alpha}\right)$$

Since $\frac{\theta_{s-1}}{\theta_s}$ is decreasing in s, $h_{t,t+s}^{hqe}$ falls over time.

C.1.7 Proof of Proposition 3

In a LQE, average quality is given by:

$$\overline{\theta} = \mu_0\left(\frac{(1-\delta)\left(1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha-1}\right)+\left(\frac{\theta_m}{\theta_H}\right)^{\alpha-1}}{(1-\delta)\left(1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}\right)+\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}}\right)$$

Differentiate with respect to each threshold:

$$\begin{aligned}
\frac{\partial\overline{\theta}}{\partial\theta_L} &= \frac{\mu_o(\alpha-1)}{1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}+\frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}}\left(\frac{1}{\theta_L}\right)\left(\frac{\theta_m}{\theta_L}\right)^{\alpha-1}\left(1-\frac{\overline{\theta}}{\theta_L}\right)<0 \\
\frac{\partial\overline{\theta}}{\partial\theta_H} &= \frac{\frac{1}{1-\delta}\mu_o(\alpha-1)}{1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}+\frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}}\left(\frac{1}{\theta_H}\right)\left(\frac{\theta_m}{\theta_H}\right)^{\alpha-1}\left(\frac{\overline{\theta}}{\theta_H}-1\right)<0
\end{aligned}$$

$$\begin{aligned}
\frac{\partial\overline{\theta}}{\partial k} &= \frac{\partial\overline{\theta}}{\partial\theta_L}\frac{\partial\theta_L}{\partial k}+\frac{\partial\overline{\theta}}{\partial\theta_H}\frac{\partial\theta_H}{\partial k} = \frac{\mu_o(\alpha-1)}{1-\left(\frac{\theta_m}{\theta_L}\right)^{\alpha}+\frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}}\times ... \\
&\times\left[\frac{1}{1-\delta}\left(\frac{1}{\theta_H}\right)\left(\frac{\theta_m}{\theta_H}\right)^{\alpha-1}\left(1-\frac{\overline{\theta}}{\theta_H}\right)\left(\frac{1}{A_\rho-w}\right)-\left(\frac{1}{\theta_L}\right)\left(\frac{\theta_m}{\theta_L}\right)^{\alpha-1}\left(\frac{\overline{\theta}}{\theta_L}-1\right)\left(\frac{1}{w}\right)\right] \\
\frac{\partial\overline{\theta}}{\partial k} &> 0 \text{ iff } \frac{1}{1-\delta}\left(\frac{1}{\theta_H}\right)^{\alpha}\left(1-\frac{\overline{\theta}}{\theta_H}\right)\left(\frac{1}{A_\rho-w}\right)>\left(\frac{1}{\theta_L}\right)^{\alpha}\left(\frac{\overline{\theta}}{\theta_L}-1\right)\left(\frac{1}{w}\right)
\end{aligned}$$

This condition can be rewritten as

$$\delta > 1-\left(\frac{\theta_L}{\theta_H}\right)^{\alpha+1}\left(\frac{\theta_H-\overline{\theta}}{\overline{\theta}-\theta_L}\right)\left(\frac{w}{A_\rho-w}\right)$$

Then note that, starting from a steady-state ($\overline{\theta} = \mu$), the bracketed terms are $\frac{\theta_L}{\theta_H} = \frac{(\mu-k)\left(A_\rho - w\right)}{w\left(k-\left(1-A_\rho\right)\mu\right)}$ and $\frac{\theta_H - \overline{\theta}}{\overline{\theta}-\theta_L} = \frac{\frac{1}{A_\rho - w}(k-(1-w)\mu)}{\frac{1}{w}(k-(1-w)\mu)} = \frac{w}{A_\rho - w}$. Therefore $\overline{\theta}$ decreases in k if and only if

$$\delta > 1 - \left(\frac{\mu - k}{k - \left(1 - A_\rho\right)\mu}\right)^{\alpha+1} \left(\frac{A_\rho - w}{w}\right)^{\alpha-1}$$

The RHS is decreasing in μ and α, so this holds for δ not too low, α not too high and an initial μ not too low. Then starting from a LQE, a decrease in k moves up the $\overline{\theta}(\mu)$ function left of the initial μ. The new steady-state equilibrium quality and reputation are necessarily higher. If the steady-state is unique, the new steady-state has higher μ. If there are multiple steady-states, ranked by increasing μ, either the new steady-state has the same rank and higher μ, or the new steady-state has higher rank and higher μ.

The welfare effect of a subsidy σ ($\sigma = -dk$) has three components. First, for firms with θ parameters such that they sell both without and with the subsidy, the policy adds to their profits the amount it costs to the government, plus the extra profits brought by a higher reputation $\mu' > \mu$. The total effect is unambiguously positive.

Second, for new exporters that enter around θ_L because of the policy ($\theta_L < \theta < \theta_{L'}$), the net benefit NB_L of the subsidy is positive:

$$NB_L = \int_{\theta_L}^{\theta_{L'}} \left(\mu' - w\theta - k + \sigma\right) dG(\theta) - \int_{\theta_L}^{\theta_{L'}} \sigma g(\theta)\, d\theta$$

$$\begin{aligned}
NB_L &= \left(\mu' - k\right) \int_{\theta_L}^{\theta_{L'}} g(\theta)\, d\theta - w \int_{\theta_L}^{\theta_{L'}} \theta dG(\theta) \\
&= \left[\left(\mu' - k\right)\left(\left(\tfrac{\theta_m}{\theta_L}\right)^{\alpha} - \left(\tfrac{\theta_m}{\theta_{L'}}\right)^{\alpha}\right) - w\tfrac{\alpha}{\alpha-1}\theta_m \left(\left(\tfrac{\theta_m}{\theta_L}\right)^{\alpha-1} - \left(\tfrac{\theta_m}{\theta_{L'}}\right)^{\alpha-1}\right)\right] \\
&= w\theta_m \left[\left(\tfrac{\theta_{L'}}{\theta_L}\left(\tfrac{\theta_m}{\theta_L}\right)^{\alpha-1} - \left(\tfrac{\theta_m}{\theta_{L'}}\right)^{\alpha-1}\right) - \tfrac{\alpha}{\alpha-1}\left(\left(\tfrac{\theta_m}{\theta_L}\right)^{\alpha-1} - \left(\tfrac{\theta_m}{\theta_{L'}}\right)^{\alpha-1}\right)\right] \\
&> \tfrac{w\theta_m}{\alpha-1}\left(\left(\tfrac{\theta_m}{\theta_L}\right)^{\alpha-1} - \left(\tfrac{\theta_m}{\theta_{L'}}\right)^{\alpha-1}\right) > 0
\end{aligned}$$

where we go from the second to the third line using $w\theta_{L'} = \mu' - k$.

Third, for new exporters that enter around θ_H because of the policy ($\theta_{H'} < \theta < \theta_H$), the net benefit NB_H of the subsidy is also positive:

$$\begin{aligned}
NB_H &= \int_{\theta_{H'}}^{\theta_H} \left(\sum_{t=0}^{\infty} \delta^t \left(\rho(t)\theta + (1 - \rho(t))\mu' - w\theta - k + \sigma\right)\right) g(\theta)\, d\theta - ... \\
&... \tfrac{1}{1-\delta} \int_{\theta_{H'}}^{\theta_H} \sigma g(\theta)\, d\theta
\end{aligned}$$

$$
\begin{aligned}
&= \tfrac{1}{1-\delta} \int_{\theta_{H'}}^{\theta_H} \left(\left(A_\rho - w \right) \theta + \left(1 - A_\rho \right) \mu' - k \right) g\left(\theta\right) d\theta \\
&= \tfrac{1}{1-\delta} \left[- \left(k - \left(1 - A_\rho\right) \mu' \right) \left(\left(\tfrac{\theta_m}{\theta_{H'}}\right)^{\alpha} - \left(\tfrac{\theta_m}{\theta_H}\right)^{\alpha} \right) + \tfrac{\alpha\left(A_\rho - w\right)}{\alpha-1} \theta_m \left(\left(\tfrac{\theta_m}{\theta_{H'}}\right)^{\alpha-1} - \left(\tfrac{\theta_m}{\theta_H}\right)^{\alpha-1} \right) \right]
\end{aligned}
$$

$$
\begin{aligned}
&= \tfrac{1}{1-\delta} \left(A_\rho - w\right) \theta_m \left[\left(\left(\tfrac{\theta_m}{\theta_{H'}}\right)^{\alpha-1} - \tfrac{\theta_{H'}}{\theta_H} \left(\tfrac{\theta_m}{\theta_H}\right)^{\alpha-1} \right) - \tfrac{\alpha}{\alpha-1} \left(\left(\tfrac{\theta_m}{\theta_{H'}}\right)^{\alpha-1} - \left(\tfrac{\theta_m}{\theta_H}\right)^{\alpha-1} \right) \right] \\
&> \tfrac{1}{1-\delta} \left(A_\rho - w\right) \tfrac{\theta_m}{\alpha-1} \left(\left(\tfrac{\theta_m}{\theta_{H'}}\right)^{\alpha-1} - \left(\tfrac{\theta_m}{\theta_H}\right)^{\alpha-1} \right) > 0
\end{aligned}
$$

So the overall welfare gain is positive.

C.1.8 Proof of Proposition 4

In a HQE, average quality is given by $\overline{\theta} = \mu_0 \left(\frac{1+K(\alpha-1)}{1+K(\alpha)} \right)$ where $K\left(\alpha\right) \equiv \sum_{T=\tilde{T}}^{\infty} \delta^T \left(\frac{\theta_m}{\theta_T}\right)^{\alpha}$ and $\theta_T = \frac{k-(1-\rho(T))\mu}{\rho(T)-w}$. Using the derivations in the proof of Proposition 1, we have

$$
\begin{aligned}
\frac{\partial \theta_T}{\partial k} &= \frac{1}{\rho\left(T\right) - w} > 0 \quad \text{for all } T > \tilde{T} \\
\frac{\partial \overline{\theta}}{\partial k} &= \sum_{T=\tilde{T}}^{\infty} \frac{\partial \overline{\theta}}{\partial \theta_T} \frac{\partial \theta_T}{\partial k} > 0
\end{aligned}
$$

Hence a subsidy that lowers k shifts down the $\overline{\theta}\left(\mu\right)$ function. As $\overline{\theta}$ is decreasing in μ in the HQE region, the new steady-state equilibrium defined by $\overline{\theta}\left(\mu\right) = \mu$ necessarily has lower μ. So average quality and national reputation are higher in the HQE steady-state without subsidies than with subsidies.

C.1.9 Proof of Proposition 5

This appendix section provides a sketch of the proof of Proposition 5. It essentially relies on the stability of μ_S and μ'_S and the instability of μ_U. For (i) and (ii), let us show that if μ_S is a steady-state LQE and $\frac{\partial \overline{\theta}(\mu)}{\partial \mu} < 0$ at μ_S, then μ_S is a stable equilibrium for $\eta < 1$. Define $\theta_{L,S} \equiv \frac{\mu_S - k}{w}$ and $\theta_{H,S} \equiv \frac{k-\left(1-A_\rho\right)\mu_S}{A_\rho - w}$. At time $t-1$ the economy is in an initial steady-state where

$$
\mu_S = \overline{\theta}\left(\mu_S\right) = \mu_0 \left(\frac{1 - \left(\frac{\theta_m}{\theta_{L,S}}\right)^{\alpha-1} + \left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha-1}}{1 - \left(\frac{\theta_m}{\theta_{L,S}}\right)^{\alpha} + \left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha}} \right)
$$

Suppose $\overline{\theta}$ is locally decreasing in μ. Then for all $\mu_S < \mu < \mu_U$, $\overline{\theta}(\mu) < \mu$. Now suppose there is a perturbation at time t such that $\mu_t = \mu_S + \varepsilon$, $\varepsilon > 0$ and $\varepsilon < \mu_U - \mu_S$. The entry thresholds at t are:

$$\begin{aligned}\theta_{L,t} &= \frac{\mu_t - k}{w} = \frac{\mu_S + \varepsilon - k}{w} \\ \theta_{H,t} &= \frac{k - (1-\delta)\sum_{u=0}^{\infty}(1-\rho(u))\,\mu_{t+u}}{A_\rho - w}\end{aligned}$$

where $\theta_{H,t}$ is determined by the zero intertemporal profits condition

$$\sum_{u=0}^{\infty} \delta^u \left[(\rho(u) - w)\,\theta_{H,t} + (1-\rho(u))\,E_t\mu_{t+u} - k\right]$$

and the absence of aggregate uncertainty allows us to remove the expectations operator.

Let us conjecture, to be verified, that $\mu_S \leq \mu_{t+u+1} \leq \mu_{t+u} \leq \mu_S + \varepsilon$ for all $u \geq 1$. Then:

$$\begin{aligned}&\theta_{L,S} < \theta_{L,t+u+1} < \theta_{L,t+u} < \theta_{L,t} \\ &\theta_{H,S} > \theta_{H,t+u+1} > \theta_{H,t+u} > \theta_{H,t}\end{aligned} \qquad \text{for all } u \geq 1$$

The average quality of exports is determined by the θ_L and θ_H thresholds in the periods after the shock in the following manner: for $u \geq 0$,

$$\begin{aligned}\overline{\theta}_{t+u} &= \mu_0 \left(\frac{1 - \left(\frac{\theta_m}{\theta_{L,t+u}}\right)^{\alpha-1} + \sum_{l=0}^{u} \delta^{u-l}\left(\frac{\theta_m}{\theta_{H,t+l}}\right)^{\alpha-1} + \sum_{l=u+1}^{\infty} \delta^l \left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha-1}}{1 - \left(\frac{\theta_m}{\theta_{L,t+u}}\right)^{\alpha} + \sum_{l=0}^{u} \delta^{u-l}\left(\frac{\theta_m}{\theta_{H,t+l}}\right)^{\alpha} + \sum_{l=u+1}^{\infty} \delta^l \left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha}} \right) \\ \theta_{L,t+u} &= \frac{\mu_{t+u} - k}{w} \\ \theta_{H,t+u} &= \frac{k - (1-\delta)\sum_{l=0}^{\infty}(1-\rho(l))\,\mu_{t+u+l}}{A_\rho - w}\end{aligned}$$

At time t, let us define $\overline{\theta}_t^{perm}$ as the average quality that would prevail if firms expected the shock to be permanent, i.e. if $E_t\mu_{t+u} = \mu_t$ for all $u \geq 0$. We calculate:

$$\overline{\theta}_t = \mu_0 \left(\frac{1 - \left(\frac{\theta_m}{\theta_{L,t}}\right)^{\alpha-1} + \left(\frac{\theta_m}{\theta_{H,t}}\right)^{\alpha-1} + \frac{\delta}{1-\delta}\left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha-1}}{1 - \left(\frac{\theta_m}{\theta_{L,t}}\right)^{\alpha} + \frac{\delta}{1-\delta}\left(\frac{\theta_m}{\theta_{H,t}}\right)^{\alpha} + \frac{\delta}{1-\delta}\left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha}} \right)$$

$$\overline{\theta}_t < \overline{\theta}_t^{perm} = \mu_0 \left(\frac{1 - \left(\frac{\theta_m}{\theta_{L,t}}\right)^{\alpha-1} + \left(\frac{\theta_m}{\theta_{H,t}^{perm}}\right)^{\alpha-1} + \frac{\delta}{1-\delta}\left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha-1}}{1 - \left(\frac{\theta_m}{\theta_{L,t}}\right)^{\alpha} + \frac{\delta}{1-\delta}\left(\frac{\theta_m}{\theta_{H,t}^{perm}}\right)^{\alpha} + \frac{\delta}{1-\delta}\left(\frac{\theta_m}{\theta_{H,S}}\right)^{\alpha}} \right)$$

as $\theta_{H,t}^{perm} = \frac{k - \left(1-A_\rho\right)(\mu_S+\varepsilon)}{A_\rho - w} < \theta_{H,t}$ from the conjecture $\mu_S \leq \mu_{t+u+1} \leq \mu_{t+u} \leq \mu_S + \varepsilon$ for all $u \geq 1$.

Also

$$\overline{\theta}_t^{perm} < \overline{\theta}\left(\mu_S + \varepsilon\right) < \mu_t$$

The first inequality results from $\theta_{H,S} > \theta_{H,t}^{perm}$. The second inequality comes from $\overline{\theta}\left(\mu\right) < \mu$ for $\mu \in \left(\mu_S, \mu_U\right)$. Hence $\overline{\theta}_t < \mu_t$ and therefore:

$$\overline{\theta}_t < \mu_{t+1} = \mu_t + \eta\left(\overline{\theta}_t - \mu_t\right) < \mu_t$$

Additionally as long as η is not too close to 1, $\mu_{t+1} > \mu_S$.

We can show, similarly, that in all subsequent periods, $\overline{\theta}_{t+u} < \mu_{t+u}$ as long as $\mu_{t+u} > \mu_S$. Thus $\mu_{t+u+1} < \mu_{t+u}$ for all u and the conjecture that μ_{t+u} follows a decreasing path from $\mu_S + \varepsilon$ to μ_S is verified. In case of a negative shock to μ at time t starting from a steady-state where $\overline{\theta}$ is locally decreasing in μ, the proof is identical with opposite signs. It follows that if μ_S is a steady-state reputation and $\overline{\theta}\left(\mu\right)$ is locally decreasing in μ at μ_S, then μ_S is stable. Any positive shock, starting from μ_S, that brings μ_t to a value in $\left(\mu_S, \mu_U\right)$ has no long-run effects as the economy moves back to μ_S.

By the same reasoning, μ_U is unstable. Suppose there is a negative shock to μ starting from

$$\mu_U = \overline{\theta}\left(\mu_U\right) = \mu_0\left(\frac{1 - \left(\frac{\theta_m}{\theta_{L,U}}\right)^{\alpha-1} + \left(\frac{\theta_m}{\theta_{H,U}}\right)^{\alpha-1}}{1 - \left(\frac{\theta_m}{\theta_{L,U}}\right)^{\alpha} + \left(\frac{\theta_m}{\theta_{H,U}}\right)^{\alpha}}\right)$$

where $\theta_{L,U} \equiv \frac{\mu_U - k}{w}$, $\theta_{H,U} \equiv \frac{k - \left(1 - A_\rho\right)\mu_U}{A_\rho - w}$ and $\overline{\theta}\left(\mu\right)$ is increasing in μ at μ_U. At time t, $\mu_t = \mu_U - \varepsilon$, where $\varepsilon > 0$ and $\varepsilon < \mu_U - \mu_S$. We conjecture $\mu_S \leq \mu_{t+u+1} \leq \mu_{t+u} \leq \mu_U - \varepsilon$, which implies $\theta_{L,S} < \theta_{L,t+u+1} < \theta_{L,t+u} < \theta_{L,U}$ and $\theta_{H,S} > \theta_{H,t+u+1} > \theta_{H,t+u} > \theta_{H,U}$ for all $u \geq 0$. Then $\overline{\theta}_{t+u} < \mu_{t+u}$ and thus $\mu_{t+u+1} < \mu_{t+u}$ for all $u \geq 0$.

For part (iii), consider a "large shock", starting from μ_S, as a shock $\varepsilon > \mu_U - \mu_S$ such that if $\mu_t = \mu_S + \varepsilon$, then $\underline{\mu} > \mu_U$, where $\overline{\theta}_t$ is defined as in (ii) and $\underline{\mu}$ is defined below. $\overline{\theta}_{t+u}$, $\theta_{L,t+u}$ and $\theta_{H,t+u}$ are defined as in part (ii). Also, for $\mu_U < \mu < \mu_S'$, we know that $\overline{\theta}\left(\mu\right) > \mu$. We can then show that $\overline{\theta}_{t+u}$ is increasing in u as long as $\overline{\theta}_{t+u} < \mu_S'$, and μ_{t+u} is increasing in u for $u \geq \underline{u}$ if $\mu_{t+u} > \mu_U$ for all $u \geq 0$. $\underline{u}$ is the inflexion point of the path of μ_{t+u}, which can initially decrease but is eventually increasing as long as $\mu < \mu_S'$. Define $\underline{\mu} = \mu_{t+\underline{u}}$, a large reputation shock is a shock such that $\underline{\mu} > \mu_U$. It ensures that reputation and average quality both grow along the transition path until the economy reaches the steady-state μ_S'.

Finally, note that more entry and higher reputation in the long-run imply higher aggregate profits and higher average quality. The latter follows from $\overline{\theta} = \mu$ in the long run. The former results from a higher number of active firms and the fact that the range of firms which are active both with the initial μ and with the higher final μ receive a higher sequence of prices.

C.1.10 Proof of Appendix C Results

Proposition 6: Part (i) follows immediately from $\theta_L = \frac{\frac{\mu}{\tau} - k}{w}$ and $\theta_H = \frac{k - \frac{1}{\tau}(1-A_\rho)\mu}{\frac{1}{\tau}A_\rho - w}$. The proof of part (ii) uses the derivations of Proposition 2. We know

$$\begin{aligned}
\overline{\theta} &= \mu_0 \left(\frac{(1-\delta)\left(1 - \left(\frac{\theta_m}{\theta_L}\right)^{\alpha-1}\right) + \left(\frac{\theta_m}{\theta_H}\right)^{\alpha-1}}{(1-\delta)\left(1 - \left(\frac{\theta_m}{\theta_L}\right)^{\alpha}\right) + \left(\frac{\theta_m}{\theta_H}\right)^{\alpha}} \right) \\
\frac{\partial \overline{\theta}}{\partial \tau} &= \frac{\partial \overline{\theta}}{\partial \theta_L}\frac{\partial \theta_L}{\partial \tau} + \frac{\partial \overline{\theta}}{\partial \theta_H}\frac{\partial \theta_H}{\partial \tau} = \frac{\frac{1}{\tau^2}\frac{\mu_o}{\theta_m}(\alpha-1)}{1 - \left(\frac{\theta_m}{\theta_L}\right)^{\alpha} + \frac{1}{1-\delta}\left(\frac{\theta_m}{\theta_H}\right)^{\alpha}} \times \ldots \\
\ldots &\times \left[\frac{1}{1-\delta}\left(\frac{\theta_m^\alpha}{\theta_H^\alpha}\right)\left(1 - \frac{\overline{\theta}}{\theta_H}\right)\left(\frac{(1-A_\rho)\mu + A_\rho\theta_H}{\frac{1}{\tau}A_\rho - w}\right) - \left(\frac{\theta_m^\alpha}{\theta_L^\alpha}\right)\left(\frac{\overline{\theta}}{\theta_L} - 1\right)\left(\frac{\mu}{w}\right) \right]
\end{aligned}$$

$\frac{\partial \overline{\theta}}{\partial \tau} > 0$ iff $\frac{1}{1-\delta}\left(\frac{1}{\theta_H}\right)^{\alpha}\left(1 - \frac{\overline{\theta}}{\theta_H}\right)\left(\frac{(1-A_\rho)\mu + A_\rho\theta_H}{\frac{1}{\tau}A_\rho - w}\right) > \left(\frac{1}{\theta_L}\right)^{\alpha}\left(\frac{\overline{\theta}}{\theta_L} - 1\right)\left(\frac{\mu}{w}\right)$. This condition can be rewritten as

$$\delta > 1 - \left(\frac{\theta_L}{\theta_H}\right)^{\alpha+1}\left(\frac{\theta_H - \overline{\theta}}{\overline{\theta} - \theta_L}\right)\left(\frac{w}{\frac{1}{\tau}A_\rho - w}\frac{(1-A_\rho)\mu + A_\rho\theta_H}{\mu}\right)$$

Then note that, starting from a steady-state ($\overline{\theta} = \mu$), the bracketed terms are: $\frac{\theta_L}{\theta_H} = \frac{\left(\frac{1}{\tau}\mu - k\right)\left(\frac{1}{\tau}A_\rho - w\right)}{w\left(k - \frac{1}{\tau}(1-A_\rho)\mu\right)}$ and $\frac{\theta_H - \overline{\theta}}{\overline{\theta} - \theta_L} = \frac{w}{\frac{1}{\tau}A_\rho - w}$. Therefore $\overline{\theta}$ decreases in τ if and only if

$$\delta > 1 - \left(\frac{\frac{1}{\tau}\mu - k}{k - \frac{1}{\tau}(1-A_\rho)\mu}\right)^{\alpha+1}\left(\frac{\frac{1}{\tau}A_\rho - w}{w}\right)^{\alpha-1}\left(1 - A_\rho + \frac{A_\rho\theta_H}{\mu}\right)$$

Under this condition, starting from a LQE, an increase in τ moves down the $\overline{\theta}(\mu)$ function. The new steady-state equilibrium quality and reputation are lower.

Proposition 7: In a HQE with trade costs,

$$\begin{aligned}
\theta^* &= \frac{k}{\frac{1}{\tau} - w} \\
\theta_T &= \frac{k - \frac{1}{\tau}(1 - \rho(T))\mu}{\frac{1}{\tau}\rho(T) - w}
\end{aligned}$$

Part (i) follows from (C.2) and modified Assumption 1 that θ_T increases with τ.

Part (ii) is similar to the proof of Proposition 4. In a HQE, average quality is $\overline{\theta} = \mu_0 \left(\frac{1+K_\tau(\alpha-1)}{1+K_\tau(\alpha)}\right)$ where $K_\tau(\alpha) \equiv \sum_{T=\tilde{T}}^{\infty} \delta^T \left(\frac{\theta_m}{\theta_T}\right)^\alpha$ and $\theta_T = \frac{k-\frac{1}{\tau}(1-\rho(T))\mu}{\frac{1}{\tau}\rho(T)-w}$. Then

$$\begin{aligned}
\frac{\partial \theta_T}{\partial \tau} &= \left(\frac{1}{\tau^2}\right) \frac{(1-\rho(T))\,\mu + \rho(T)\,\theta_T}{\frac{1}{\tau}\rho(T) - w} > 0 \quad \text{for all } T > \tilde{T} \\
\frac{\partial \overline{\theta}}{\partial \tau} &= \sum_{T=\tilde{T}}^{\infty} \frac{\partial \overline{\theta}}{\partial \theta_T} \frac{\partial \theta_T}{\partial \tau} > 0
\end{aligned}$$

using the derivations in the proof of Proposition 1. Hence an rise in the ad valorem tariff τ shifts up the $\overline{\theta}(\mu)$ function. As $\overline{\theta}$ is decreasing in μ in the HQE region, the new steady-state equilibrium defined by $\overline{\theta}(\mu) = \mu$ necessarily has higher μ. So average quality and national reputation are higher, and the volume of trade is lower, in the new steady state.

C.2 Informed and Uninformed Buyers

Suppose the population of importers is divided into N equal-sized groups. There is perfect information diffusion within groups but no information diffusion across groups. Thus, if any individual in group n has previously consumed the output of firm j, then all buyers in group n are informed about good j. When firm j is matched with buyer i, $i \in I$ if there exists $i' \in n$ such that i' has been matched with j in the past, and $i \in U$ if there is no $i' \in n$ such that i' has been matched with j in the past. Further assume that the firm observes in any period whether its buyer is informed or not, but not which group the buyer belongs to; hence it does not know the exact proportion of informed buyers in any period but only its expectation.

It follows immediately from this setup that $\rho(0) = 0$. After the firm has exported for one period, one group is informed, so $\rho(1) = \frac{1}{N}$. For each subsequent period, if the fraction of informed buyers after s export periods is $\rho(s)$, then with probability $\rho(s)$, the firm is matched with a buyer in an informed group, and the proportion of informed importers stays at $\rho(s)$ for the next period. With probability $1-\rho(s)$, the firm is matched with a buyer in an uniformed group; then the fraction of informed importers next period is $\rho(s) + \frac{1}{N}$.

Therefore, the expected fraction of informed buyers is given by the following path: for $s \geq 0$,

$$\begin{aligned}
\rho(0) &= 0 \\
\rho(s+1) &= \rho(s)^2 + (1-\rho(s))\left(\rho(s) + \frac{1}{N}\right) = \rho(s)\left(\frac{N-1}{N}\right) + \frac{1}{N}
\end{aligned}$$

We can check that this function satisfies Assumption 1.

$$
\begin{aligned}
\rho(s+1)-\rho(s) &= \frac{1}{N}(1-\rho(s))>0 \\
\frac{\rho(s+1)-\rho(s)}{\rho(s)} &= \frac{1}{N}\left(\frac{1}{\rho(s)}-1\right) \quad \text{is decreasing in } s \\
\lim_{s\to\infty}\rho(s) &= \frac{1}{N}\left(1-\frac{N-1}{N}\right)^{-1}=1
\end{aligned}
$$

So $\rho(s)$ is increasing in s, rises with s at a falling rate, and converges to 1.

C.3 Ad Valorem Tariffs

A straightforward extension of the model allows for ad valorem trade costs. Suppose that when a buyer pays $p_{t+s}(j)$ defined by (3.6) for the output of firm j, the firm receives $\frac{1}{\tau}p_{t+s}(j)$, where $\tau>1$. The price being set by the importer's maximum willingness to pay, trade costs are borne by exporters.

We modify Assumption 2 accordingly: let us assume $\frac{1}{\tau}\rho(1)>w$. With positive trade costs, the values of the relevant thresholds are modified as follows:

$$
\theta^{*} = \frac{k}{\frac{1}{\tau}-w} \tag{C.1}
$$

$$
\theta_L = \frac{\frac{\mu}{\tau}-k}{w} \tag{C.2}
$$

$$
\theta_H = \frac{k-\frac{1}{\tau}\left(1-A_\rho\right)\mu}{\frac{1}{\tau}A_\rho-w} \tag{C.3}
$$

$$
\theta_T = \frac{k-\frac{1}{\tau}\left(1-\rho(T)\right)\mu}{\frac{1}{\tau}\rho(T)-w} \tag{C.4}
$$

An increase in τ lowers export profits for all firms. In a LQE, it widens the range of non-exporters. In a HQE, it leads low-quality firms below θ^* to exit sooner. Also, holding constant the economy's exogenous parameters (α, δ, θ_m, k, and w), a higher τ makes it more likely that the steady-state equilibrium is a LQE. The existence condition for a HQE with tariffs is

$$
\alpha\left(\frac{\theta_m\left(\frac{1}{\tau}-w\right)}{k}\right)+\frac{\delta}{1-\delta}\left(\frac{\theta_m\left(\frac{1}{\tau}-w\right)}{k}\right)^{\alpha}>\alpha-1 \tag{C.5}
$$

Proposition 14 *An increase in the ad-valorem tariff τ in a low-quality steady-state equilibrium:*

(i) Lowers θ_L and raises θ_H;

(ii) Lowers the average quality of exports and equilibrium country reputation if $\left(\frac{\frac{1}{\tau}\mu-k}{k-\frac{1}{\tau}(1-A_\rho)\mu}\right)^{\alpha+1}\left(\frac{\frac{1}{\tau}A_\rho-w}{w}\right)^{\alpha-1}\left(1-A_\rho+\frac{A_\rho\theta_H}{\mu}\right)>1-\delta.$

See Appendix C.1.10 for proofs. In a LQE, an increase in τ discourages entry by some relatively low-quality firms (as θ_L falls) as well as some relatively high-quality firms (as θ_H rises). Under the stated condition, the latter dominates in the net effect of τ on $\overline{\theta}$. Thus, a higher tariff, similarly to a higher k, results in lower steady-state quality in a LQE.

Proposition 15 *An increase in the ad-valorem tariff τ in a high-quality steady-state equilibrium:*

(i) Increases θ_T for all T and lowers the survival rate of exporters below θ^*;

(ii) Increases the average quality of exports and equilibrium country reputation.

See Appendix C.1.10 for proofs. In a HQE, from an initial steady-state where $\overline{\theta}=\mu>\theta^*$, an increase in tariffs induces firms with below-average quality in (θ_m,θ^*) to exit sooner, and has no impact on the exit rate of firms with above-average quality ($\theta>\overline{\theta}$). Hence higher trade costs lead to a smaller mass of active exporters and a higher average quality of their products. Conversely, trade liberalization raises the volume of exports and lowers their average quality in high-quality countries, but brings about better average quality and unit prices, as well as higher trade volume, in low-quality countries.

C.4 Hazard Rates

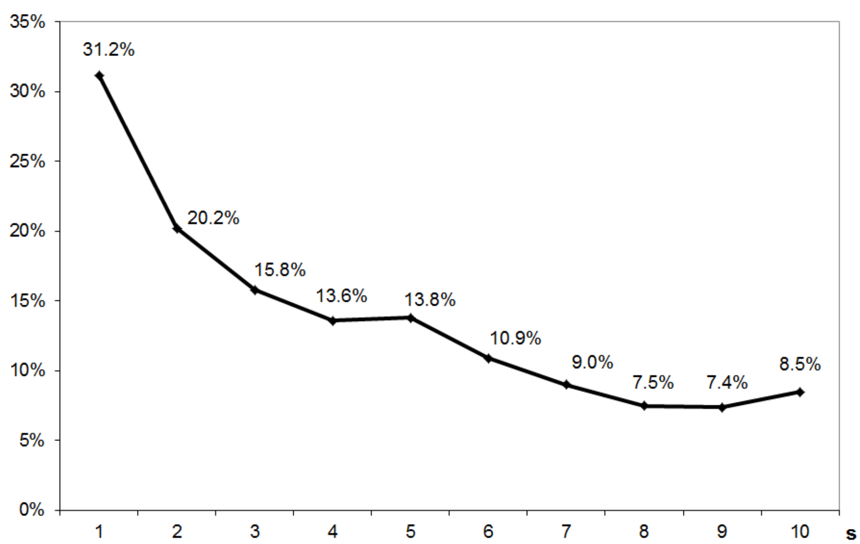
We calculate hazard rates at the 10-digit product level in US manufacturing imports (SITC codes 5-8) over 1989-2006, using data from Robert Feenstra. HS-10 products in the data are the equivalent of firms in our model. The exit rate is calculated for each country, HS-2 industry and export duration. Specifically, the survival rate of products from country c, industry i and export experience s at time t is the number of 10-digit products that are exported to the US for the $(s+1)$-th time from country c in industry i, divided by the number of 10-digit products from the same country and industry that were exported at time $t-1$ for the s-th time. The hazard rate is one minus the survival rate.

We find that across countries and industries, the average hazard rate falls with export experience. Furthermore, hazard rates for products from non-OECD members are higher than those of OECD members for all export durations, consistent with higher exit rates in countries exporting lower-quality goods.

Table C.1: *Hazard Rates in US Manufacturing Imports.*

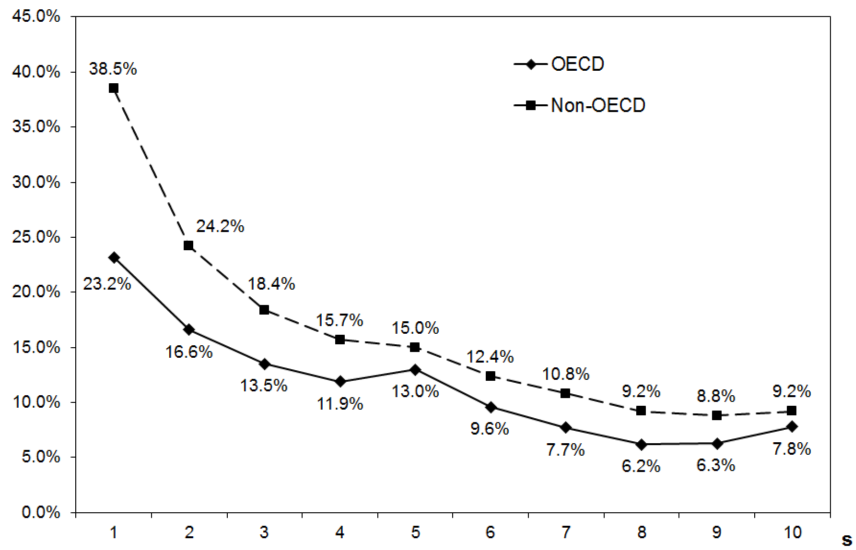
	Hazard rate		
s	All	OECD	Non-OECD
1	31.2%	23.2%	38.5%
2	20.2%	16.6%	24.2%
3	15.8%	13.5%	18.4%
4	13.6%	11.9%	15.7%
5	13.8%	13.0%	15.0%
6	10.9%	9.6%	12.4%
7	9.0%	7.7%	10.8%
8	7.5%	6.2%	9.2%
9	7.4%	6.3%	8.8%
10	8.5%	7.8%	9.2%

Notes: HS-10 level, 1989-2006.



Notes: Countries with s Years of Export Experience in US Imports, 1989-2006.

Figure C.1: *Hazard Rates of Products from all Countries*



Notes: OECD and non-OECD Countries with *s* Years of Export Experience in US Imports, 1989-2006.

Figure C.2: *Hazard Rates of Products from OECD and non-OECD Countries*